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Storm Water Source Control Evaluation
Operable Unit 3
Swan Island Upland Facility
Portland, Oregon

Prepared for:
Port of Portland

March 10, 2010
1115-08

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

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Definintions

Catch Basin. A structure located just below the ground surface used to collect storm water runoff for conveyance purposes. Generally located in streets and parking lots, catch basins have grated lids, allowing storm water from the surface to pass through for collection. Catch basins also include a sumped bottom and submerged outlet pipe (downturned 90-degree elbow, hood, or baffle board) to trap coarse sediment and oils.

Inlet. A structure (other than a catch basin) that captures and conveys storm water directly to surface water or the storm sewer system. Examples include scupper drains, dock drains, field inlets, or grated manholes.

Storm Sewer. A sewer designed to carry only storm water and surface water, including street flow; excludes domestic wastewater and industrial wastes.

1.0 Introduction

A storm water evaluation (SWE) was conducted at Operable Unit 3 (OU3) at the Swan Island Upland Facility (SIUF; the Facility) located in Portland, Oregon (Figure 1). The SWE was completed at the request of the Oregon Department of Environmental Quality (DEQ), received in a letter by the Port of Portland (Port), dated July 21, 2008. The SWE was conducted in accordance with the Storm Water Evaluation Work Plan (Work Plan) dated October 20, 2008 (Ash Creek, 2008).

The purpose of the SWE was to evaluate whether storm water from the Facility may be a potential source/pathway for future adverse impact to the Swan Island Lagoon (the Lagoon). This work was performed to support a No Further Action (NFA) determination for the Facility.

1.1 Scope of SWE

The scope of work for the SWE included the following:

- Step 1 – Characterizing the storm water basin;
  - Defining the storm drain system;
  - Identifying contaminants of interest (COI);
- Step 2 – Preparing Work Plan for storm water sampling;
- Step 3 – Conducting SWE sampling; and
- Step 4 – Reporting.

This report (Step 4 in the above process) describes the activities and results of Steps 1 through 3 of the SWE.

1.2 Report Organization

This report is organized as follows:

- Section 2 describes the Facility and the existing storm drain system, and summarizes Facility operations and available relevant environmental assessment information.
- Section 3 describes the sampling and analysis procedures for the SWE.
- Section 4 lays out the overall methodology for the storm water system cleaning and solids characterization.
- Section 5 describes the chemical analytical results and screens the storm water and storm water system solids data against the screening level values (SLVs) in the Joint Source Control Strategy (JSCS) guidance document (DEQ/EPA, 2005).

2.0 Background

This section describes the Facility storm drain system and summarizes existing relevant data.

2.1 Facility Description and Uses

The Facility consists of approximately 2.8 acres located on the east side of Swan Island at 5420 N. Lagoon Avenue. The upland area (not including the riverbank) is approximately 2.5 acres. OU3 is bounded by the ordinary line of high water (OLHW) along the Lagoon on the north, OU1 on the west/northwest, Daimler on the east/southeast, and N. Lagoon Avenue on the south (Figure 2). Except for the riverbank, the topography of the Facility is relatively flat, with an elevation of approximately 30 feet above mean sea level (MSL). An office/warehouse building is present on the main parcel, which is almost entirely paved with asphalt-concrete. The adjacent parcel includes an asphalt-concrete roadway that provides vehicle access to Berth 308 and contains no structures (Appendix A, Photograph 1). The only unpaved areas are the vegetated riverbank and a landscaping strip along N. Lagoon Avenue (Figure 3). The area southeast of the office/warehouse building is used for vehicle parking.

2.1.1 Current and Recent Facility Use

Tetra Tech, Inc. is the current lessee (as of September 1, 2009) of most of the upland parcel. The leasehold consists of approximately 1.8 acres that includes the office/warehouse building and the adjacent paved parking and yard areas located southeast and northwest of the office/warehouse building, respectively. Tetra Tech, Inc. is using the Facility to support its conduit construction activities, including storing vehicles, trailers, and utility materials (e.g., conduit and cable); vehicle and equipment maintenance within the warehouse building; and general office use. Activities do not include marine operations or other water-dependent uses.

Daimler/Freightliner LLC (Freightliner) leased the upland parcel (minus the roadway along the top of bank and the riverbank) from June 2004 through February 2009 to collect truck performance data for the improvement of future truck designs and operations. Engine research and development, engine assembly, and storage occurred at the Facility. The Facility was not used by Freightliner as a marine terminal.

A catch basin is present in the warehouse area (Figure 3). The catch basin was constructed with the building in 1980. It was connected to the sanitary sewer via an oil/water separator (OWS). The original building tenant reportedly filled the OWS with concrete prior to 1990 to prevent accidental discharge of petroleum or vehicle maintenance fluids to the sanitary sewer (Hahn, 2002). Since then, the catch basin has served as a blind sump. The Freightliner staff indicated that at the start of their lease they confirmed the system had been filled with concrete. The catch basin was observed to be clean and dry during a September 2008 visit to the Facility.

2.1.2 Historical Facility Uses

Historical Aerial Photograph Review. A historical aerial photograph review was completed by Hahn and Associates, Inc. (Hahn) in 2002 (Hahn, 2002). Following is a summary of the observations made by Hahn, supplemented with review of additional historical aerial photographs completed as part of the preparation of the Work Plan.

- 1929 and 1936. The Facility, along with the adjoining parcels to the north, south, and east of the property, was undeveloped. The central and eastern portions of the property sloped downward to the east, and appeared to be substantially lower in elevation than at present.
- 1940. The western portion of the Facility appeared to be used for automobile parking.
- 1948. The eastern portion of the Facility appeared to have been filled to the level of the western portion of the Facility.
- 1955. No significant changes to the Facility were observed.
- 1963. The Facility did not appear to be paved. The property was undeveloped with the exception of what appeared to be a small shed on the northeastern portion.
- 1967, 1972, and 1976. The Facility was paved with asphalt-concrete and was used for automobile parking.
- 1980. The existing office/warehouse building on the Facility was constructed.
- 1986. Trucks were parked on the western portion of the Facility.
- 1991. No significant changes to the Facility were observed.
- 1995. No significant changes to the Facility were observed.
- 1997. No significant changes to the Facility were observed.
- 2001. No significant changes to the Facility were observed except that several storage trailers were located on the southeastern portion of the Facility.

Facility Operations and Tenancy. The building currently present on the Facility (Building 70) was constructed in 1980 for use by Crosby and Overton Marine and Environmental Cleaning, Inc. (Crosby & Overton). Chemical Processors, Inc. (CPI) – a similar company – assumed the lease of the property in October 1989. CPI was purchased by Burlington Environmental, Inc. (Burlington) in January 1992. Foss Environmental (Foss) purchased Burlington in November 1992, and assumed occupancy of the property at that time (Hahn, 2002).

Throughout the period of successive owners/operators, the office/warehouse building was used to store containment booms, vacuum trucks, pumps, and other environmental incident response equipment on site. The DEQ indicated in an interoffice memo that Crosby & Overton performed industrial cleaning and disposal for their clients, and confirmed that the wastes generated were hauled directly to recycling facilities (DEQ, 1980). Crosby & Overton performed similar services at their Operable Unit 1 (OU1) leasehold before moving to OU3 in 1980.

Mr. Darrell Winegar, who worked at the subject property from 1980 through 1987, indicated in an interview with Hahn that several 3,000-gallon steel aboveground storage tanks (ASTs) were stored on the northern portion of the property from approximately 1980 through 1984, and were used to temporarily store oily bilge water from ships (Hahn, 2002). Mr. Winegar indicated that he was unaware of any storage of hazardous materials at the property with the exception of the bilge water tanks and a gasoline underground storage tank (UST). In 1983, the U.S. Environmental Protection Agency (EPA) inspected Crosby & Overton uses of Building 70 and sampled waste oil stored in two portable ASTs at the Facility to test for polychlorinated biphenyls (PCBs; EPA, 1983a). The waste oil samples were below detection limits for PCBs (EPA, 1983b).

During the Foss tenancy, containerized wastes and petroleum-impacted soil were occasionally stored in the asphalt-paved parking and equipment storage area for short durations prior to being shipped off site (Hahn, 2002).

2.2 Facility Setting

2.2.1 Geology

Regional Geology. The SIUF is located in the Portland Basin, a bowl-like structure bounded by folded and faulted uplands. The basin has been filled with up to 1,400 feet of alluvial and glacio-fluvial flood deposits. These sediments overlie older (Eocene and Miocene) rocks, including the Columbia River Basalt Group, Waverly Heights basalt, and older marine sediments. Regional geologic units present beneath the Facility (from the ground surface downward) include Recent Fill (primarily dredged river sediment); fine-grained Pleistocene Flood Deposits and Recent Alluvium (undifferentiated); coarse-grained Pleistocene Flood Deposits (gravels); Upper Troutdale Formation; Lower Troutdale Formation/Sandy River Mudstone; and Columbia River Basalt Group.

Local Geology. Phase I and II investigations performed at the SIUF characterized geologic conditions to approximately 40 feet below the ground surface (bgs). The subsurface soils beneath the SIUF are mixtures of silt, sandy silt, silty sand, sand, and sand with gravel. In general, sand and occasional gravel is encountered to a depth of approximately 20 feet bgs. These materials represent the Willamette River dredged materials that were placed on Swan Island when it was reconfigured and raised in elevation in the 1920s. Underlying the Recent Fill is Recent Alluvium (associated with the original Swan Island) that consists of variable mixtures of silt, sandy silt, silty sand, and sand.

2.2.2 Hydrogeology

Regional Hydrogeology. The major hydrogeologic units found in the area, proceeding from uppermost to lowermost, are Fill, Fine-grained Facies of Flood Deposits, and Recent Alluvium (FFA); Coarse-grained

Flood Deposits and Upper Troutdale Formation (CGF); Lower Troutdale Formation/Sandy River Mudstone; and Columbia River Basalt Group. Of these, the FFA and CGF are the two hydrogeologic units that are relevant to the SIUF. The FFA ranges in thickness from 30 to 100 feet. It is the primary unit of importance in defining the interactions between upland groundwater and the river. The distribution of textures, and thus groundwater flow properties of the unit, varies both vertically and horizontally by location. Typical hydraulic conductivities can range over several orders of magnitude depending upon whether the unit contains silt and clay, silty sand, or sand. The CGF has an overall thickness in the range of 100 feet. This unit may act as a preferential groundwater flow pathway to deeper units and for deeper groundwater flow to the river where the unit is present adjacent to the river.

Local Hydrogeology. Shallow groundwater occurs under water table conditions at the SIUF. The depth to groundwater in monitoring wells installed on OU1 and OU2 ranges from approximately 18 to 30 feet bgs. Shallow groundwater is recharged by the infiltration of precipitation that falls on Swan Island. Shallow groundwater discharges to the Willamette River and the Lagoon. Beneath the SIUF, the groundwater flow direction is radially outward from the middle of Swan Island toward the Willamette River and the Lagoon. At OU3, the expected groundwater flow direction is to the northeast toward the Lagoon.

Groundwater elevations near the Willamette River and Swan Island shorelines fluctuate in response to diurnal tidal cycles and seasonal changes in Willamette River elevations. Groundwater monitoring performed between December 2001 and December 2005 on OU1 and OU2 found that groundwater elevations in wells installed near the shoreline fluctuated approximately 8 feet. Further inland, toward the middle of Swan Island, the response to changes in river elevations is less pronounced, with observed fluctuations of less than 1 foot.

Surface Water. There are no surface waters on the Facility. The Lagoon borders the Facility. Precipitation falling on the Facility is captured by the storm water collection system.

2.3 Drainage Basin Area and Storm Water System

Figure 4 presents the approximate drainage basins and storm water conveyance system at the Facility, including six inlet locations (designated WR-030 through WR-035 by the City of Portland [City]), and storm water flow directions. Prior to 1968, Port drawings indicate that the six inlets and an asphalt-concrete surface were present at the Facility. Definitions of storm system features are presented following the table of contents of this report.

Basin A (approximately 0.8 acre) is comprised of driveways and landscaped areas along N. Lagoon Avenue. Storm water infiltrates or sheet flows to the street, where it is captured by the City storm sewer system. The roof drains from the office/warehouse are also included in Basin A as they drain to the City system along N. Lagoon Avenue.

Basin B (approximately 1.7 acres) captures storm water from the remaining asphalt-concrete-paved surfaces at the Facility. The runoff is directed to six storm water inlets. Figure 5 shows a storm water cross-section schematic for the Facility, including a typical inlet. The inlets consist of a grated, rectangular concrete sump with an outlet at the bottom (Appendix A, Photograph 2) connected to a 10-inch corrugated metal pipe that discharges down the riverbank to the Lagoon (Appendix A, Photographs 3 and 9). The depth to groundwater is approximately 18 feet (minimum) bgs (approximately 13 feet minimum below the discharge from the storm water inlets).

Basin C (approximately 0.3 acre) is comprised of the vegetated riverbank between the top of bank and the OLHW. A curb is present at the top of the riverbank along the boundary of Basins B and C (Photograph 8). Storm water infiltrates or moves as sheet flow to the Lagoon in Basin C.

2.4 Other Facility Utilities

Figure 3 shows the utilities present on the Facility (sanitary sewer, electric, water). These utilities were installed in 1980 as part of site development.

One pad-mounted electrical transformer is present on-site on the southwestern exterior of the office/warehouse building (Appendix A, Photograph 4). The transformer is owned by Portland General Electric (PGE) and labeled "non-PCB".

2.5 Storm Water Permits and Best Management Practices (BMPs)

Storm water discharges from the Facility are subject to the Port's National Pollution Discharge Elimination System (NPDES) DEQ Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314.

2.5.1 Port BMPs

The Port has implemented numerous best management practices (BMPs) at OU3 as part of its tenant and licensee contracts, Environmental Management System Program, and continual improvement policy. The following is a list of BMPs that are specifically related to the activities conducted as part of the NPDES MS4 permit (Port, 2006).

- The Port oversees the permitted property uses by Port tenants through lease obligations. This includes oversight of the activities undertaken at a property, as well as environmental management and compliance, including:
    - Storage and handling of regulated substances;
    - BMPs as appropriate (e.g., covered storage, materials, and maintenance areas; proper waste chemical handling, storage, and disposal; good housekeeping practices);

- Development and implementation of a comprehensive Spill Prevention and Response Plan (SPAR); and
- Development and maintenance of environmental compliance plans as required. Port regular inspection, cleaning, and maintenance of storm water conveyance system to prevent blocking, accumulations, and discharge of pollutants.

- Port deployment of filter inserts for the six Facility inlets on February 10, 2010 including regular maintenance (annual) to prevent sediment loading.
- Port membership in the City's Regional Spill Committee and Maritime Fire and Safety Association, which are organizations committed to spill prevention and response, and the ongoing protection of maritime environments.
- Port administration of training program for all effected Port personnel who play a role in the protection of storm water.

The Port completed a storm water conveyance system cleanout as part of regular maintenance on July 21, 2008 (see Section 4 for additional details).

During the week of March 23, 2009, the Port removed accumulated vegetation/moss on the asphalt-concrete surface along the top of the riverbank (Appendix A, Photographs 7 and 8). The asphalt-concrete surface at the Facility was cleaned by dry sweeping, pressure washing (along the fence line), and wet sweeping. Residuals from this sweeping were managed by the Port's Marine Facility Maintenance (MFM) personnel. Waste residuals consolidated with similar waste streams from other Port facilities. These residuals are subsequently profiled for waste characterization to determine appropriate disposal or treatment.

2.5.2 Freightliner Storm Water Pollution Controls and BMPs

Freightliner maintained a Spill Prevention Control and Countermeasure (SPCC) Plan for the Facility. The objectives of the SPCC Plan were to prevent spills from occurring, prepare for possible spills, and respond if a spill does occur. The SPCC Plan indicated the presence of the following ASTs located in the warehouse (Daimler, 2008; Appendix A, Photographs 5 and 6):

- 250 gallons of used engine coolant (rectangular, double-walled);
- 250 gallons of used motor oil (rectangular, double-walled); and
- Various 55-gallon drums (new motor oil, engine coolant, washer fluid, etc.) on mobile spill pans.

All of the noted ASTs were removed by Freightliner when they vacated the Facility. Vehicle fueling completed by Freightliner was performed off-site.

As part of their SPCC Plan, Freightliner maintained a linear absorbent boom along the 0.3-acre riverbank access road adjacent to their leasehold (Appendix A, Photograph 1). An absorbent sock continues to surround each storm water inlet (Photograph 7). The daily and weekly inspection checklists included in the Freightliner SPCC Plan included observations of the absorbent booms. Freightliner indicated that the boom material was replaced on an as-needed/annual basis. A spill containment kit was available in the shop area (Photograph 5), and Freightliner implemented an employee awareness and training program.

The inlets on the Facility were included in the Freightliner annual maintenance program. The most recent cleanout was performed on December 21, 2007 (invoice included in Appendix B of the Work Plan). West Coast Marine Cleaning pumped out the storm water inlets and installed new absorbent socks around each inlet.

2.5.3 Tetra Tech Spill Prevention Plan and BMPs

Tetra Tech implements BMPs within its leasehold in the form of developing SPAR noted above. Prohibited uses under the premises lease include hazardous substance storage in aboveground, underground, or mobile tanks; washing of vehicles or equipment without Port consent; and fueling of vehicles or equipment without Port consent.

2.6 Summary of Additional Relevant Assessment Information

2.6.1 Underground Storage Tank Removal

DEQ records indicate that a 2,000-gallon gasoline UST was decommissioned by removal in October 1987. A permit on record with the Portland Fire Bureau indicated that the UST was installed in February 1980. The approximate location of the former UST is shown on Figure 3. A subsurface investigation was completed in the vicinity of the former UST in 2004. Total petroleum hydrocarbons (TPH) as oil were detected in one sample above the DEQ Soil Matrix Level 2 Cleanup Standard. The groundwater results were non-detect (Hahn, 2004).

2.6.2 Historical Electrical Equipment

As part of preparation of the Supplemental Preliminary Assessment (PA; Ash Creek, 2006) for the SIUF, the Port identified a former United States-era substation on the Facility (Substation M) that may have utilized electrical equipment containing PCBs. Surface soil samples were collected at the location of the former Substation M in May 2007 in accordance with a request from the DEQ. Soil samples were collected at the four corners of an approximately 30- by 30-foot square centered on the estimated location of the former substation (Figure 3). The samples were collected just below the asphalt-concrete/sub-base using direct-push equipment. No field indications of volatile organic compounds (VOCs) or petroleum hydrocarbons were observed in any of the borings. No TPH or PCBs were detected above the method reporting limits (MRLs) in the soil samples collected (Ash Creek, 2007).

2.7 Historical Releases/Spills

Port records were reviewed and no historical releases or spills were identified. The Supplemental PA prepared for SIUF (including OU3) concluded that no potential areas of concern (other than the former United States-era substation discussion in Section 2.6.2) were identified for OU3.

3.0 Storm Water Sampling and Analysis

The methods and procedures used to complete the SWE are presented in this section. Interim data reports were submitted by the Port following each sampling event in accordance with the DEQ request (DEQ, 2008).

3.1 SWE Sampling Event Criteria

The SWE at the Facility consisted of sampling and analysis of four qualifying storm events. Storm event criteria were developed and presented in the Work Plan (Ash Creek, 2008). The criteria were generally consistent with the Storm Event Criteria and Selection described in the JSCS guidance document (DEQ/EPA, 2005). The storm event criteria are as follows:

1) Each sampling event is preceded by an antecedent dry period of at least 24 hours (as defined by less than 0.1 inch of precipitation over the previous 24 hours);
2) Minimum predicted rainfall volume of greater than 0.2 inch per event; and
3) Expected storm event duration of at least three hours.

A rain gauge at the Swan Island Pump Station (approximately 1,500 feet from the Facility; maintained by the City of Portland Hydra Network) was used to confirm that the sampling criteria were met. The rain gauge lists the rainfall depth per hour (reported on a one- to three-hour time delay). The rain gauge data are found at the following internet address:

http://or.water.usgs.gov/non-usgs/bes/swan_island_pump.rain

3.1.1 Contaminants of Interest

The COI selected for the sampling program were consistent with those requested by the DEQ for sampling activities conducted for other media at the SIUF, including: TPH, PCBs, metals, and phthalates. These COI are consistent with chemicals detected in the samples collected from the storm water cleanout (Section 4). In addition, analysis for tributyltin (TBT) and Total Suspended Solids (TSS) was requested by the DEQ (DEQ, 2008).

3.1.2 Storm Events

Samples were collected during the 2009 season from inlets WR-030, -032, and -034, and analyzed for the COI. The storm water sampling events are described below.

February 23, 2009 Storm Event

Ash Creek Associates, Inc. (Ash Creek) personnel mobilized to OU3 in the morning of February 23, 2009 to collect samples from inlets WR-030, -032, and -034 (Figure 4). A storm of greater than 0.2 inch was predicted. Storm water runoff was occurring upon arrival. Samples were collected between 10:40 am and 1:40 pm on February 23. The storm had a duration of nine hours and measured 0.32 inch of rainfall. A hydrograph is presented on Figure 6. The 24-hour period prior to the sampling event met the criteria for the "antecedent dry period". No deviations from the Work Plan occurred during this event.

March 14, 2009 Storm Event

Ash Creek personnel mobilized to OU3 in the afternoon of March 14, 2009 to collect samples from inlets WR-030, -032, and -034. A storm of greater than 0.2 inch was predicted. Storm water runoff was occurring upon arrival. Samples were collected between 5:25 pm and 5:45 pm on March 14. The storm had a duration of 20 hours and measured 0.93 inch of rainfall. The rain gauges at Terminal 4 and Yeon were reviewed to confirm that the storm event continued between the hours of 5:00 pm and 6:00 pm (when a break in precipitation was recorded at the Swan Island gauge). A hydrograph is presented on Figure 7. The 24-hour period prior to the sampling event met the criteria for the "antecedent dry period". No deviations from the Work Plan occurred during this event.

April 12, 2009 Storm Event

Ash Creek personnel mobilized to OU3 in the morning of April 12, 2009 and deployed the storm water samplers in inlets WR-030, -032, and -034 (Figure 4). A storm of greater than 0.2 inch was predicted. Ash Creek returned to the site at 5:45 pm. Storm water runoff was occurring upon arrival. Samples were collected at 6:09 pm and 6:20 pm. A sample could not be collected from inlet WR-032. (The Port completed a site-wide pavement cleaning at OU3 on March 23, 2009, which included removal of moss on the asphalt-concrete surface along the top of the riverbank [as noted in section 2.5.1]. The moss removal exposed a series of cracks in the pavement around the inlet to WR-032, through which infiltration was occurring. No discharge of storm water to the inlet was observed after the moss removal.) The storm had a duration of five hours and measured 0.17 inch of rainfall. A hydrograph is presented on Figure 8. The 24-hour period prior to the sampling event met the criteria for the "antecedent dry period". No other deviations from the Work Plan occurred during this event.

April 27, 2009 Storm Event

Ash Creek personnel mobilized to OU3 in the night of April 27, 2009 and deployed the storm water samplers in inlets WR-030 and -034. A storm of greater than 0.2 inch was predicted. Storm water runoff was occurring upon arrival. There was no discharge to inlet WR-032 due to infiltration into cracks in the asphalt-concrete pavement (consistent with the April 12, 2009 event). Ash Creek returned to the site at 11:55 pm. Samples were collected at 12:05 and 12:15 am on April 28, 2009. The storm had a duration of five hours and measured 0.18 inch of rainfall. A hydrograph is presented on Figure 9. The 24-hour period prior to the sampling event met the criteria for the "antecedent dry period". No deviations from the Work Plan occurred during this event with the exception of the inability to sample at location WR-032.

3.2 Storm Water Sampling Procedures

Whole-water grab samples were obtained from inlets WR-030, -032 and -034 in accordance with Standard Operating Procedure (SOP) 2.12 (Appendix B). The outlet at the bottom of each storm water inlet is connected to a 10-inch corrugated metal pipe that discharges to the Lagoon (Photograph 3). The metal outfall pipes are located on a steep riverbank and the outlets are commonly submerged (Photograph 9), except during low-water months.

A stainless steel storm water sampling pan was constructed to allow for sample collection (Photograph 8). The decontaminated sampling pans were deployed after removing the grated inlet covers. Samples were collected with a disposable polyethylene bottle and transferred into large, pre-cleaned bulk sample containers (with the exception of TPH as gasoline [TPHg] where VOA vials were directly filled from the disposable polyethylene bottle). The laboratory split the samples into the required volumes for analysis, filtering where applicable.

3.2.1 Laboratory Analysis

Following each sampling event, the samples were transported to TestAmerica, Inc. in Beaverton, Oregon for analysis. The samples were picked up by the laboratory courier or dropped off by Ash Creek personnel, following chain-of-custody protocols.

The storm water samples were analyzed for some or all of the following analyses:

- PCBs as Aroclors by EPA Method 8082;
- Polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270C-SIM;
- Total and dissolved metals by EPA 6000/7000 Series Methods (including arsenic, cadmium, copper, lead, mercury, and zinc);
- Phthalates by EPA Method 525.5;

- TBT by the Krone Method;
- TPHg by Northwest Method NWTPH-Gx;
- Diesel- and oil-range TPH (TPHd and TPHo, respectively) by Northwest Method NWTPH-Dx (with silica gel cleanup); and
- TSS per AHPA/EPA Methods.

The lowest practicably obtainable MRLs were requested from the analytical laboratory.

3.3 Other Observations

Shoreline Monitoring. Because of the limited inflows and essentially no current, the Lagoon acts as a collection point for floating debris and sheen. A sheen on the Lagoon was observed adjacent to the Facility during a Port/DEQ site visit conducted in November 2007. As discussed in the Port's June 30, 2008 letter to the DEQ, there was no indication that the sheen originated at the Facility, nor was it confirmed that the sheen was of hydrocarbon origin. It is more likely that the sheen was due to releases from ship traffic, other more significant storm water discharges, or the presence of naturally occurring organics in the Lagoon. A minor sheen was observed on the water at the southern end of the Facility during a Port/DEQ site visit conducted on October 1, 2008 (Appendix A, Photograph 10). The sheen was floating offshore adjacent to other debris that had accumulated in the Lagoon below the OLHW. It was not discernable whether the sheen was related to naturally occurring organics or the presence of hydrocarbons.

Monthly monitoring of the shoreline was conducted during the period of storm water sampling (January through April 2009) to assess for potential sheen associated with the Facility. No sheen was observed (Appendix A, Photographs 11 through 14).

WR-031 Inspection. No inflow was observed during the storm water sampling from the inflow pipe connection to the WR-031 inlet. More information on this pipe connection is included in Section 4.1.

4.0 Storm Water Cleanout

The storm water cleanout was completed as part of regular maintenance on July 21, 2008. The scope, procedures, and results of the cleanout were presented in the Port's June 30, 2008 letter to the DEQ and are described below.

4.1 Storm Water Cleanout Approach

The storm water cleanout was completed by Terra Hydr, under subcontract to Ash Creek. Ash Creek personnel oversaw the field activities and completed necessary system observations and sampling.

Removal of Dry Solids. Grates were manually removed and solids from each inlet were vacuumed out.

Jetting of Drain Lines. Each corrugated metal outfall pipe was cleaned per the following procedure:

- A vacuum line was attached to discharge of the outfall pipe (Photograph 3). In cases where the outfalls were below the water line, a portion of the pipe was removed to allow for connection to the vacuum line.
- A Vactor hydro-jet truck, equipped with a 1,200- to 1,500-pound-per-square-inch (psi) jet head, a 500-foot spool of hose, and a vacuum tank, was used to jet-wash the lines from the inlets to the end of the outfalls.
- The rinsate was vacuumed into the Vactor truck and taken to Cascade General for treatment.

WR-031 Inlet Video Inspection. An inflow pipe connection to the WR-031 inlet was observed during the cleanout. A video camera survey was conducted to assess a potential connection to the inlet. The results of the video survey indicated that the line was plugged approximately 10 feet from the inlet.

4.2 Sampling and Analysis

Two types of samples were collected for chemical analysis during the storm water cleanout: (1) site-wide composites of the dry solids removed from the inlets; and (2) wet material removed from conveyance lines.

- Dry solids samples (sample identification "SIUF-Inlet") were collected from dry material physically removed from inlets during the cleaning process.
- Wet, settled solids samples (sample identification "SIUF-Lines") were collected from solids that settled within the vacuum truck. Prior to departure to Cascade General, the vacuum truck was allowed to sit for at least 30 minutes. Solids that dropped out of suspension were collected in an 8-ounce jar and submitted for chemical analysis.

Storm water solids samples submitted to the laboratory were analyzed for the following:

- PCBs as Aroclors by EPA Method 8082;
- PAHs by EPA Method 8270C-SIM;
- Metals by EPA 6000/7000 Series Methods (including arsenic, cadmium, copper, lead, mercury, and zinc);
- Phthalates by EPA Method 8270C-SIM;
- TPHg by Northwest Method NWTPH-Gx;
- TPHd and TPHo by Northwest Method NWTPH-Dx (with silica gel cleanup); and
- Toxicity Characteristic Leaching Procedure (TCLP) metals (dry solids sample only).

4.3 Waste Management

Approximately 1,200 gallons of rinsate and suspended solids were delivered to Cascade General for treatment. The volume of suspended solids was not quantified. The dry solids collected during the cleanout were placed in a labeled drum approved by the Oregon Department of Transportation (ODOT) for transporting hazardous waste. Less than 5 gallons of solids were present.

The TCLP analysis of the dry solids sample indicated the detected concentration of lead was above the 40 CFR 261.24 criterion for characteristic hazardous waste. The drum of dry solids was disposed of at the Waste Management Arlington Landfill.

Receipts documenting the waste management are included in Appendix B.

5.0 Chemical Analyses and Results

The storm water samples were submitted to TestAmerica, Inc. in Beaverton, Oregon. The laboratory reports and a quality assurance review are included in Appendix C (in CD-ROM format due to the length of the Level III deliverable reports).

5.1 Storm Water Results

Table 1 presents the analytical data from the storm water sampling program. A summary of the analytical data is below.

- TSS. The concentrations of TSS ranged from non-detect to 140,000 µg/L, with maximum concentrations observed in the February 23, 2009 sampling event (prior to pavement cleaning).
- Metals. Copper, lead, and zinc were detected during each event. The highest relative concentrations were detected in samples from the February 23, 2009 event, corresponding with the highest TSS concentrations. Arsenic and cadmium were also detected in samples from the February 23, 2009 event at concentrations that were minimally above the MRLs. Dissolved metals analyses were also performed for the March 14, 2009 event. No significant difference was observed between the dissolved and total metals results for copper and zinc. Lead was not detected in the dissolved analysis.
- TBT. TBT was not detected above MRLs.
- PCBs. PCBs were not detected above MRLs in inlets WR-032 or -034. Aroclor 1260 was detected in two of three samples collected from WR-030.
- Phthalates. Bis(2-ethylhexyl)phthalate (DEHP) was detected at concentrations just above the MRL in WR-030 (one event) and WR-032 (two events). DEHP was also detected one time in WR-034 at fives times the MRL during the event with the highest relative TSS for that inlet.

- PAHs. PAHs (benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, and indeno[1,2,3-cd]pyrene) were detected at concentrations up to 0.044 microgram per liter (µg/L) in events with higher relative TSS concentrations.
- TPH. TPHd and TPHo were detected in the sample from WR-034 (collected on February 23, 2009) at concentrations that were only slightly above MRLs.

5.2 Cleanout Solids Results

Table 2 presents the analytical data from the storm water cleanout. A summary of the analytical data is below.

5.2.1 Dry Composite

The results of the dry composite sample (SIUF-Inlet) indicated the following:

- Metals. Concentrations of arsenic, cadmium, copper, lead, mercury, and zinc were detected in this sample (Table 2). A TCLP analysis was also completed on the dry composite sample for waste designation purposes. Leachable lead was detected above the characteristic hazardous waste criterion (40CFR 261.24).
- PCBs. Aroclor 1260 was detected at a concentration of 0.499 milligrams per kilogram (mg/kg).
- Phthalates. DEHP was detected at a concentration of 2.83 mg/kg.
- PAHs. Fluoranthene, pyrene, and chrysene were detected at concentrations ranging from 0.425 to 0.513 mg/kg.
- TPH. TPHo was detected at a concentration of 1,590 mg/kg.

5.2.2 Conveyance Lines

The results of the settled, wet solids sample (SIUF-Lines) indicated the following:

- Metals. Concentrations of arsenic, cadmium, copper, lead, mercury, and zinc were detected in this sample (Table 2).
- PCBs. Aroclor 1260 was detected at a concentration of 1.49 mg/kg.
- Phthalates. DEHP was detected at a concentration of 21.8 mg/kg.
- PAHs. PAHs (phenanthrene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[a]pyrene, and benzo[g,h,i]perylene) were detected at concentrations ranging from 1.79 to 11 mg/kg.
- TPH. TPHo was detected at a concentration of 59,600 mg/kg.

6.0 Data Evaluation and Analysis

The SWE results, both from the storm water sampling and storm water cleanout, are discussed further below within the context of storm water source control evaluation.

6.1 Data Evaluation

The analytical data were screened against the JSCS SLVs. The primary objective of the JSCS is to identify and evaluate potential sources of chemicals that may impact the river (DEQ/EPA, 2005).

6.1.1 Storm Water Sampling

The screening indicated the following:

- Concentrations of copper, lead, and zinc were present above the JSCS SLVs. Arsenic and cadmium were also detected above the JSCS SLVs in up to two samples;
- TBT was not detected above MRLs;
- No PCBs were detected in any of the samples collected from inlet WR-032 and WR-034; only inlet WR-030 detected Aroclor 1260 above the JSCS SLV in two of the four samples collected from this inlet;
- Concentrations of phthalates were below the JSCS SLVs, with the exception of DEHP in one sample from inlet WR-034 (February 23, 2009);
- Chrysene and/or benzo(b)fluoranthene were detected at concentrations slightly above the JSCS SLVs only in the February 23, 2009 samples from inlets WR-030 and WR-034; and
- No SLV is available for TPH, but the only total detected TPH concentrations from inlet WR-034 in the February 23, 2009 were below the 1 milligram per liter (mg/L) NPDES discharge criteria.

6.1.2 Storm Water System Cleanout

The screening of the storm water solids indicated the following:

- Arsenic, cadmium, copper, lead, mercury, and zinc were detected above the JSCS SLVs in the composite sample from the inlets. Cadmium, copper, lead, and mercury were detected above the JSCS SLVs in the composite sample from the lines;
- The detected concentrations of PCB Aroclor 1260 in the samples from the inlets and lines were above the JSCS SLVs; no other Aroclors were detected in the storm water solid samples;
- Concentrations of phthalates were below the JSCS SLVs, except for DEHP; and
- The concentrations of seven PAHs exceeded the JSCS SLVs in the sample from the lines.

Additional background data from studies of roadway catch basins in Washington State are included in Table 2 for comparison (Ecology, 1995). None of the detected metals or PAH concentrations exceeded the range of values presented by the Washington State Department of Ecology (Ecology; study did not analyze for phthalates or PCBs). The TPH concentration in the lines exceeded the range presented by Ecology by approximately six times.

6.2 Data Analysis

The concentrations of metals detected in storm water solids samples are consistent with concentrations of metals detected during other conveyance line cleanouts. Copper, lead, and zinc were detected in the storm water samples above the JSCS SLVs. However, the exceedances were generally low and appear primarily due to the very low SLV for most of these constituents. These metals are commonly attributed to anthropogenic sources such as tire and brake dust.

PCB Aroclor 1260 was detected in the storm water solids samples (dry and settleable) and in two of the 10 storm water samples. No current or historical sources of PCBs are known to be present on site. Based on the hydrophobic nature of PCBs, the detections in the storm water samples are likely attributed to sediment entrained in the samples. It is commonly recognized that PCBs are persistent organic pollutants subject to long-range atmospheric transport and deposition. It has been suggested that global sources and basin-scale residential open burning are sources of PCBs in the Willamette Basin (Hope, 2008). The presence of PCBs in the composite sample from the inlets likely represents historical accumulation of inputs from industrial, urban background or offsite sources). Although the inlets had been vacuumed by Freightliner, this method is expected to remove the heavier accumulation of material but is not considered a thorough cleaning. In contrast, the cleaning of the inlets completed in 2008 was a comprehensive removal (which yielded only about 5 gallons of material from the six inlets).

DEHP was present in the solids characterization samples above JSCS SLVs. DEHP exceeded the JSCS SLVs in storm water from inlet WR-034 during one event (February 23, 2009 – highest relative TSS event). Phthalates are used in the production of vinyl, plastic, and rubberized materials. In the absence of a manufacturing source or storage of pure phthalate materials (both absent from this Facility), phthalates are primarily present in the environment as secondary contaminants, originating from manufacturing emissions and atmospheric deposition, or from wear of tires, brake pads, and other friction-prone equipment or materials. The nominal amounts of phthalates in storm water can be attributed to routine tread wear from vehicles used at the Facility and atmospheric deposition from anthropogenic sources.

TPH and PAHs were present in solids removed from the storm water system and were also detected in storm water (only three PAH detections minimally exceeded the JSCS SLVs in one sampling event). Petroleum storage is not a primary land use at the Facility. The Facility is nearly entirely paved with asphalt-concrete. The difference in the relative magnitude between the TPH and PAH concentrations between the inlets and lines samples suggest that the lines likely contained a higher proportion of fines from weathered asphalt-concrete pavement. This is supported by observations of cracked and weathered pavement along the top of the riverbank.

In general, the highest relative concentrations of chemicals were detected in the storm water samples collected on February 23, 2009. This correlates to the highest reported TSS concentrations from the Facility. A comprehensive surface cleanup involving removal of vegetation, sweeping, and pressure washing was completed along the top of the riverbank during the week of March 23, 2009. Significantly lower TSS concentrations were reported in the events following the surface cleanup. The exceedances of storm water relative to the JSCS criteria following the surface cleanup ranged from six to 15 times, as compared to the pre-cleanup exceedances that ranged from two to 139 times.

The least soluble chemicals (TPH, PAHs, phthalates, and PCBs) are more concentrated in the solids sample from the lines (relative to the inlets). This is likely the result of differences in grain size (i.e., more sand in the inlets and more fines in the lines, trapped in the ribs of the corrugated piping).

7.0 Conclusions

A SWE was completed at OU3 at the SIUF to evaluate the storm water pathway as a potential source to the Lagoon. As summarized in this report, previous documents have indicated that the Facility is absent of potential upland contamination sources (Bridgewater, 2000; Ash Creek, 2006; Ash Creek, 2007). The Facility is almost entirely paved with asphalt-concrete. The only unpaved areas are the vegetated riverbank and a landscaping strip along N. Lagoon Avenue. Based on the evaluation of the available data, storm water does not represent a current source of contamination to the Lagoon. The following lines of evidence support this conclusion.

- A minimal number of chemicals were detected in the storm water samples exceeding the conservative JSCS criteria. Metals and PAHs detected in the OU3 samples are commonly found exceeding storm water SLVs at other industrial sites within Portland Harbor (DEQ, 2009). For bioaccumulative chemicals such as PCBs, the SLVs are extremely low and any detection generally exceeds the SLVs (DEQ, 2009).
- Detected concentrations in storm water are low and not considered significant. The exceedances of storm water concentrations relative to the JSCS criteria following the surface cleaning ranged from six to 15 times the respect chemical SLV. Significantly lower TSS concentrations were also reported in the storm water sampling events following this BMP implementation.
- The suite of detected chemicals and associated concentrations in the solids from the storm water cleanout are consistent with other conveyance system cleanouts completed by the Port and are within the expected ranges (i.e., urban background) of analytical results from studies of roadway inlets in Washington State (Ecology, 1995).
- The storm water system cleanout removed any uncertainty that accumulated solids within the system could be a source to the river.

- Storm water BMPs (e.g., filter inserts and routine inspection and maintenance) will continue to be implemented and required as part of the Facility's MS4 permit.
- Absent are historical or current Facility-derived contamination sources to the river.

8.0 References

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Tables

Table 1 - Chemical Analytical Results: Storm Water
SIUF - OU3
Portland, Oregon

	SLV for Portland Harbor[2]	WR-030					WR-032			WR-034				
		2/23/2009	3/14/2009		4/12/2009	4/28/2009	2/23/2009	3/14/2009		2/23/2009	3/14/2009		4/12/2009	4/28/2009
		Total	Total	Dissolved	Total	Total	Total	Total	Dissolved	Total	Total	Dissolved	Total	Total
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Total Suspended Solids	–	140,000	20,000	–	10,000	10,000	50,000	20,000	–	20,000	<10,000	–	<10,000	<10,000
Metals/Inorganics														
Aluminum (pH 6.5 - 9.0)	50	–	–	–	–	–	–	–	–	–	–	–	–	–
Antimony	6	–	–	–	–	–	–	–	–	–	–	–	–	–
Arsenic	0.045	**1.41**	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Arsenic III	190	–	–	–	–	–	–	–	–	–	–	–	–	–
Cadmium	0.094	**0.544**	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	**1.23**	<0.500	<0.500	<0.500	<0.500
Chromium, total	*100*	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium, hexavalent	11	–	–	–	–	–	–	–	–	–	–	–	–	–
Copper	2.7	**59.7**	**13.5**	**10.6**	**13.1**	**14.1**	**23.3**	**17.8**	**13.7**	**33.6**	**6.96**	**6.25**	**12.7**	**16.4**
Lead	0.54	**75.3**	**3.88**	<1.00	**8.13**	**1.87**	**10.4**	**2.13**	<1.00	**9.35**	<1.00	<1.00	**2.6**	**1.46**
Manganese	50	–	–	–	–	–	–	–	–	–	–	–	–	–
Mercury	0.77	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Methyl Mercury	0.0028	–	–	–	–	–	–	–	–	–	–	–	–	–
Nickel	16	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	5	–	–	–	–	–	–	–	–	–	–	–	–	–
Silver	0.12	–	–	–	–	–	–	–	–	–	–	–	–	–
Zinc	36	**228**	**124**	**109**	**236**	**138**	**134**	**84.4**	**82.2**	**498**	**78.0**	**83.2**	**101**	**134**
Perchlorate	<24.5	–	–	–	–	–	–	–	–	–	–	–	–	–
Cyanide	5.2	–	–	–	–	–	–	–	–	–	–	–	–	–
Butyltins														
Monobutyltin	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dibutyltin	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tributyltin	0.072	<0.0020	<0.0019	–	<0.0019	<0.0019	<0.0020	<0.0019	–	<0.0019	<0.0019	–	<0.0019	<0.0019
Tetrabutyltin	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PCBs Aroclors														
Aroclor 1016	0.96	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1221	0.034	<0.0943	<0.0962	–	<0.0952	<0.105	<0.0957	<0.0952	–	<0.100	<0.0962	–	<0.0952	<0.105
Aroclor 1232	0.034	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1242	0.034	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1248	0.034	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1254	0.033	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1260	0.034	**0.429**	<0.0481	–	**0.197**	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1262	–	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Aroclor 1268	–	<0.0472	<0.0481	–	<0.0476	<0.0526	<0.0478	<0.0476	–	<0.0500	<0.0481	–	<0.0476	<0.0526
Phthalate Esters														
Dimethylphthalate	3	<0.962	<0.952	–	<0.952	<0.990	<0.971	<0.962	–	<0.990	<0.952	–	<0.952	<1.0
Diethylphthalate	3	<0.962	<0.952	–	<0.952	<0.990	<0.971	<0.962	–	<0.990	<0.952	–	<0.952	<1.0
Di-n-butylphthalate	3	<0.962	<0.952	–	<0.952	<0.990	<0.971	<0.962	–	<0.990	<0.952	–	<0.952	<1.0
Butylbenzylphthalate	3	<0.962	<0.952	–	<0.952	<0.990	<0.971	<0.962	–	<0.990	<0.952	–	<0.952	<1.0
Di-n-octylphthalate	3	<0.962	<0.952	–	<0.952	<0.990	<0.971	<0.962	–	<0.990	<0.952	–	<0.952	<1.0
bis(2-Ethylhexyl)phthalate	2.2	**1.52**	<0.952	–	<0.952	<0.990	**1.99**	**1.22**	–	**5.67**	<0.952	–	<0.952	<1.0
PAHs														
Naphthalene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
2-Methylnaphthalene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Acenaphthylene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Acenaphthene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Fluorene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Phenanthrene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Anthracene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Fluoranthene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Pyrene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Benzo(a)anthracene	0.018	**0.0118**	<0.00476	–	<0.00476	<0.00495	**0.0057**	<0.00481	–	**0.00884**	<0.00476	–	<0.00476	<0.005
Chrysene	0.018	**0.0297**	<0.00476	–	**0.00631**	<0.00495	**0.0181**	**0.00985**	–	**0.0442**	<0.00476	–	**0.0076**	**0.00632**
Benzo(b)fluoranthene	0.018	**0.0209**	<0.00476	–	<0.00476	<0.00495	**0.00871**	**0.00959**	–	<0.0200	<0.00476	–	<0.00476	<0.005
Benzo(k)fluoranthene	0.018	**0.0128**	<0.00476	–	<0.00476	<0.00495	**0.00656**	**0.00624**	–	<0.0150	<0.00476	–	<0.00476	<0.005
Benzo(a)pyrene	0.018	**0.0134**	<0.00476	–	<0.00476	<0.00495	**0.00524**	<0.00481	–	<0.0100	<0.00476	–	<0.00476	<0.005
Indeno(1,2,3-cd)pyrene	0.018	**0.0119**	<0.00476	–	<0.00476	<0.00495	**0.00512**	**0.00622**	–	**0.00852**	<0.00476	–	<0.00476	<0.005
Dibenz(a,h)anthracene	0.018	<0.0048	<0.00476	–	<0.00476	<0.00495	<0.004476	<0.00481	–	<0.00500	<0.00476	–	<0.00476	<0.005
Benzo(g,h,i)perylene	0.2	<0.0959	<0.0952	–	<0.0952	<0.0990	<0.0952	<0.0962	–	<0.100	<0.0952	–	<0.0952	<0.1
Other Analytes														
TPH Diesel	–	<240	<245	–	<240	<263	<240	<240	–	**241**	<243	–	<245	<243
TPH Heavy Oil	–	<481	<490	–	<481	<526	<481	<481	–	**648**	<485	–	<490	<485
TPH-Gx	–	<80	<80	–	<80	<80	<160	<80	–	<1,600	<80	–	<80	<80
Total Organic Carbon	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Notes:

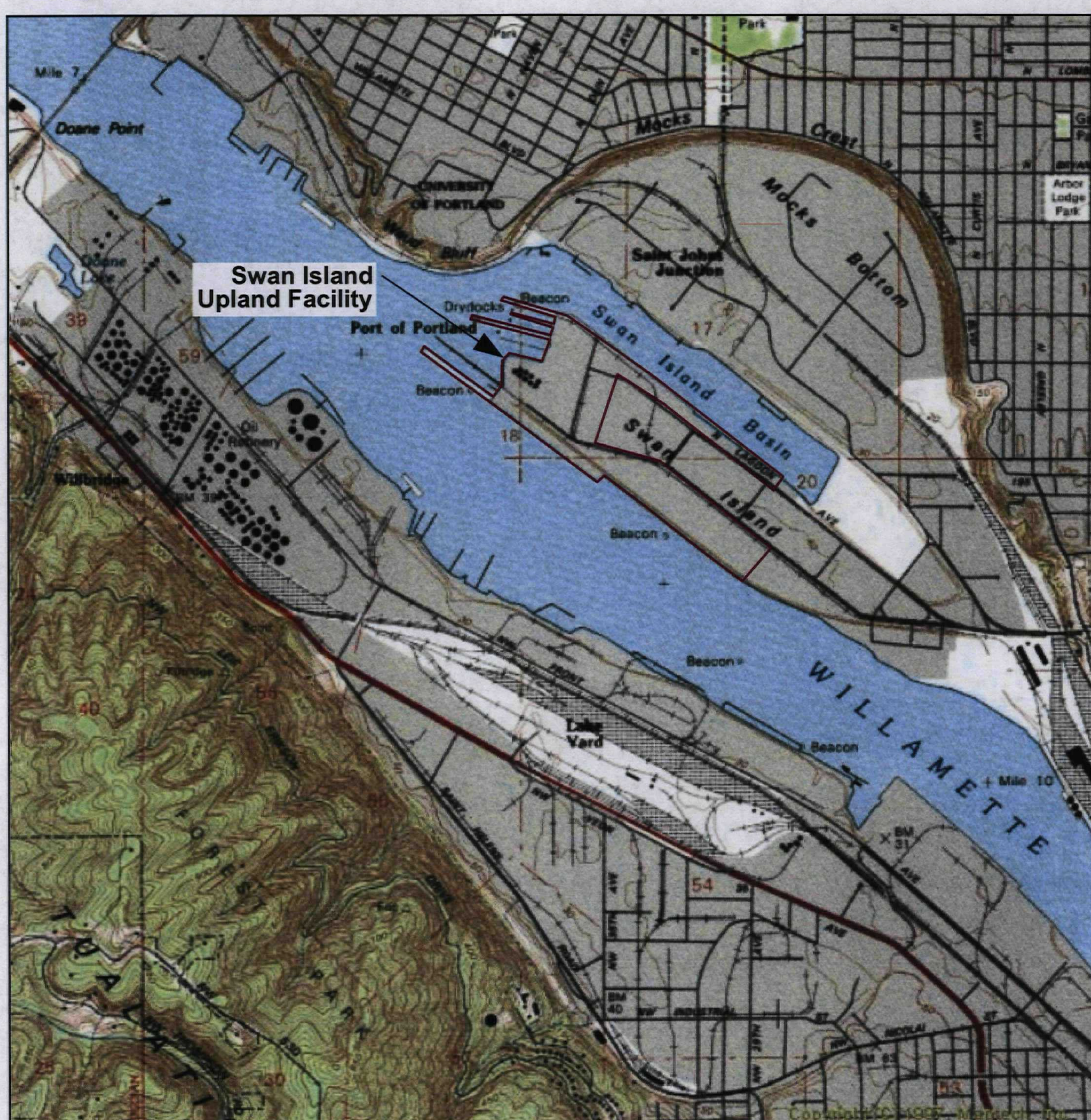
1. At Portland Harbor sites, drinking water MCLs and PRGs are also used as screening levels, per the JSCS. These values are applied when they are lower than all other screening values.
2. The source of each SLV is documented in Table 3.1 of the Portland Harbor Joint Source Control Strategy, which can be viewed at http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/docs/JSCSFinalTable03_1.pdf
3. **Bold** = Detected above the method reporting limit (MRL).
4. < = Not detected above the MRL.
5. -- = Not analyzed or not available.
6. *Shading indicates a detection that exceeds the screening criteria.*
7. µg/L = Micrograms per liter.
8. PCBs = Polychlorinated biphenyls.
9. PAHs = Polycyclic aromatic hydrocarbons.
10. TPH = Total petroleum hydrocarbons.

Table 2 - Chemical Analytical Results: Storm Water Solids
SIUF - OU3
Portland, Oregon

	Screening Value[1]	SIUF-Inlet (7/22/2008)	SIUF-Lines (7/22/2008)	Ecology 1995 Roadway Inlet Study
Units	µg/kg	µg/kg	µg/kg	µg/kg
Metals/Inorganics				
Aluminum (pH 6.5 - 9.0)	--	--	--	--
Antimony	64000	--	--	--
Arsenic	7000	**33,100**	**5,860**	4,000 - 56,000
Arsenic III	--	--	--	--
Cadmium	1000	**1,810**	**1,360**	500 - 5,000
Chromium, total	111000	--	--	13,000 - 241,000
Chromium, hexavalent	--	--	--	--
Copper	149000	**390,000**	**196,000**	12,000 - 730,000
Lead	17000	**523,000**	**316,000**	4,000 - 850,000
Manganese	1100000			--
Mercury	70	**1,790**	**2,830**	--
Methyl Mercury	--	--	--	--
Nickel	48600	--	--	14,000 - 86,000
Selenium	5000	--	--	--
Silver	5000	--	--	--
Zinc	459000	**541,000**	**545,000**	50,000 - 2,000,000
Perchlorate	--	--	--	--
Cyanide	--	--	--	--
Butyltins [12]				
Monobutyltin	--	--	--	--
Dibutyltin	--	--	--	--
Tributyltin	2.3	--	--	--
Tetrabutyltin	--	--	--	--
PCBs Aroclors				
Aroclor 1016	530	<179	<260	--
Aroclor 1221	--	<179	<260	--
Aroclor 1232	--	<179	<260	--
Aroclor 1242	--	<179	<260	--
Aroclor 1248	1,500	<179	<260	--
Aroclor 1254	300	<179	<260	--
Aroclor 1260	200	**499**	**1,490**	--
Aroclor 1262	--	<179	<260	--
Aroclor 1268	--	<179	<260	--
Total PCBs	0.39	**499**	**1,490**	--
PCB Congeners				
Phthalate Esters				
Dimethylphthalate	--	<1,670	<14,600	--
Diethylphthalate	600	<1,670	<14,600	--
Di-n-butylphthalate	100	<1,670	<14,600	--
Butylbenzylphthalate	--	<1,670	<14,600	--
Di-n-octylphthalate	--	<1,670	<14,600	--
bis(2-Ethylhexyl)phthalate	800	**2,830**	**21,800**	--
PAHs				360 - 417,000 (Total PAHs)
Naphthalene	561	<416	<1,460	--
2-Methylnaphthalene	200	--	--	--
Acenaphthylene	200	<416	<1,460	--
Acenaphthene	300	<416	<1,460	--
Fluorene	536	<416	<1,460	--
Phenanthrene	1,170	<416	**1,790**	--
Anthracene	845	<416	<1,460	--
Fluoranthene	2,230	**513**	**4,160**	--
Pyrene	1,520	**431**	**5,000**	--
Benzo(a)anthracene	1,050	<416	**2,490**	--
Chrysene	1,290	**425**	**11,000**	--
Benzo(b)fluoranthene	--	<416	**3,190**	--
Benzo(k)fluoranthene	13,000	<416	<1,460	--
Benzo(a)pyrene	1,450	<416	**1,810**	--
Indeno(1,2,3-cd)pyrene	100	<416	<1,460	--
Dibenz(a,h)anthracene	1,300	<416	<1,460	--
Benzo(g,h,i)perylene	300	<416	**1,880**	--
Other Analytes				123,000 - 11,049,000 (Total TPH)
TPH Diesel	--	<761	**6,810,000**	--
TPH Heavy Oil	--	**1,590,000**	**59,600,000**	--
TPH-Gx	--	<4,810	<8,010	--
Total Organic Carbon	--			
Total Solids	--			

Notes:
1. The source of each SLV is documented in Table 3.1 of the Portland Harbor Joint Source Control Strategy, which can be viewed at http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/docs/JSCSFinalTable03_1.pdf
2. DEQ 08-LQ-076.
3. **Bold** = Detected above the method reporting limit (MRL).
4. < = Not detected above the MRL.
5. -- = Not analyzed or not available.
6. Shading indicates a detection that exceeds the screening criteria.
7. µg/kg = Micrograms per kilogram.
8. PCBs = Polychlorinated biphenyls.
9. PAHs = Polycyclic aromatic hydrocarbons.
10. TPH = Total petroleum hydrocarbons.

Figures



Base map prepared from USGS 7.5-minute quadrangles as provided by Topozone. (1990)

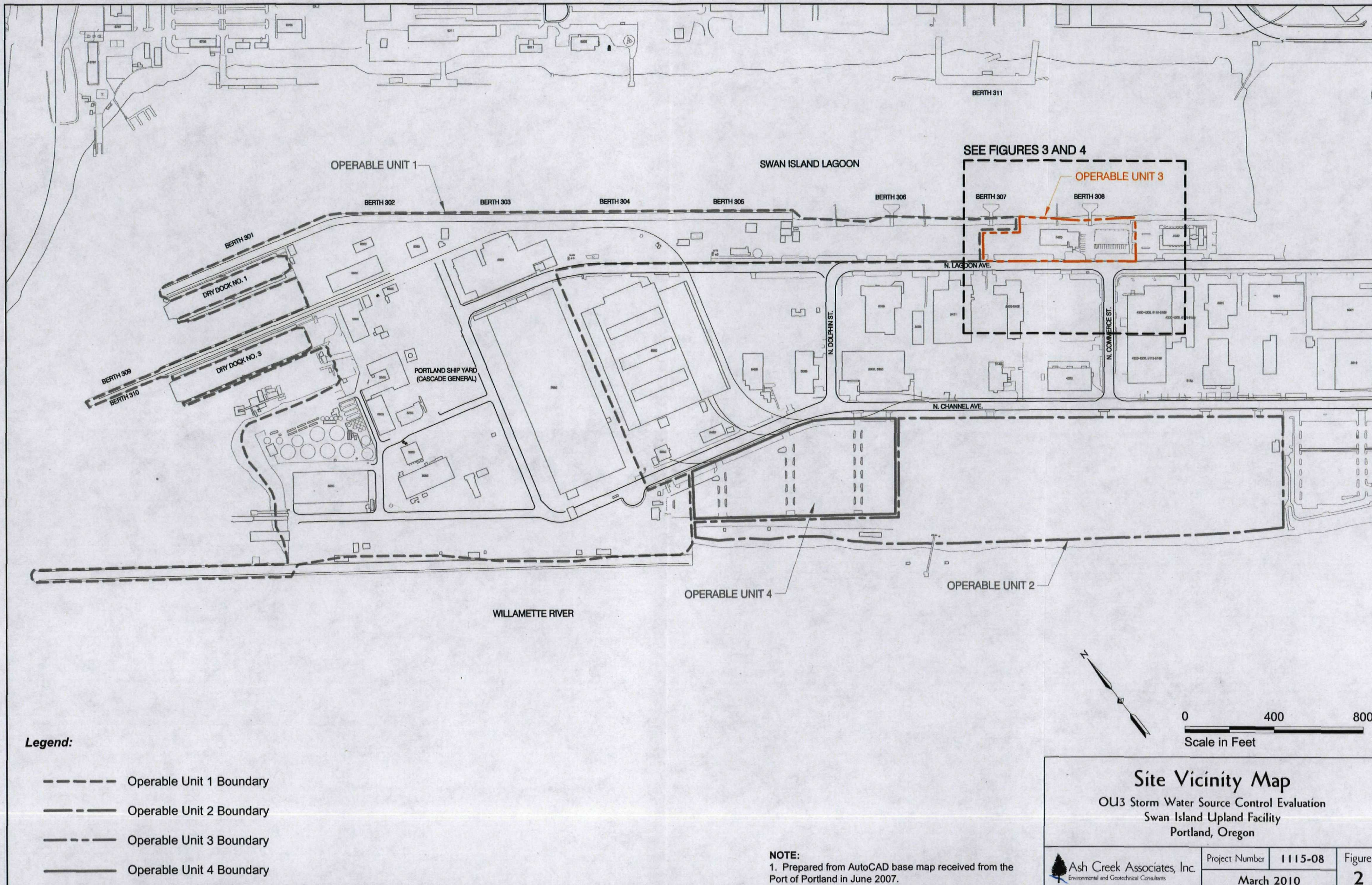
N

0 2,000 4,000
Approximate Scale in Feet

Facility Location Map

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number	1115-08	Figure
	March 2010		1



Legend:

- Operable Unit 1 Boundary
- Operable Unit 2 Boundary
- Operable Unit 3 Boundary
- Operable Unit 4 Boundary

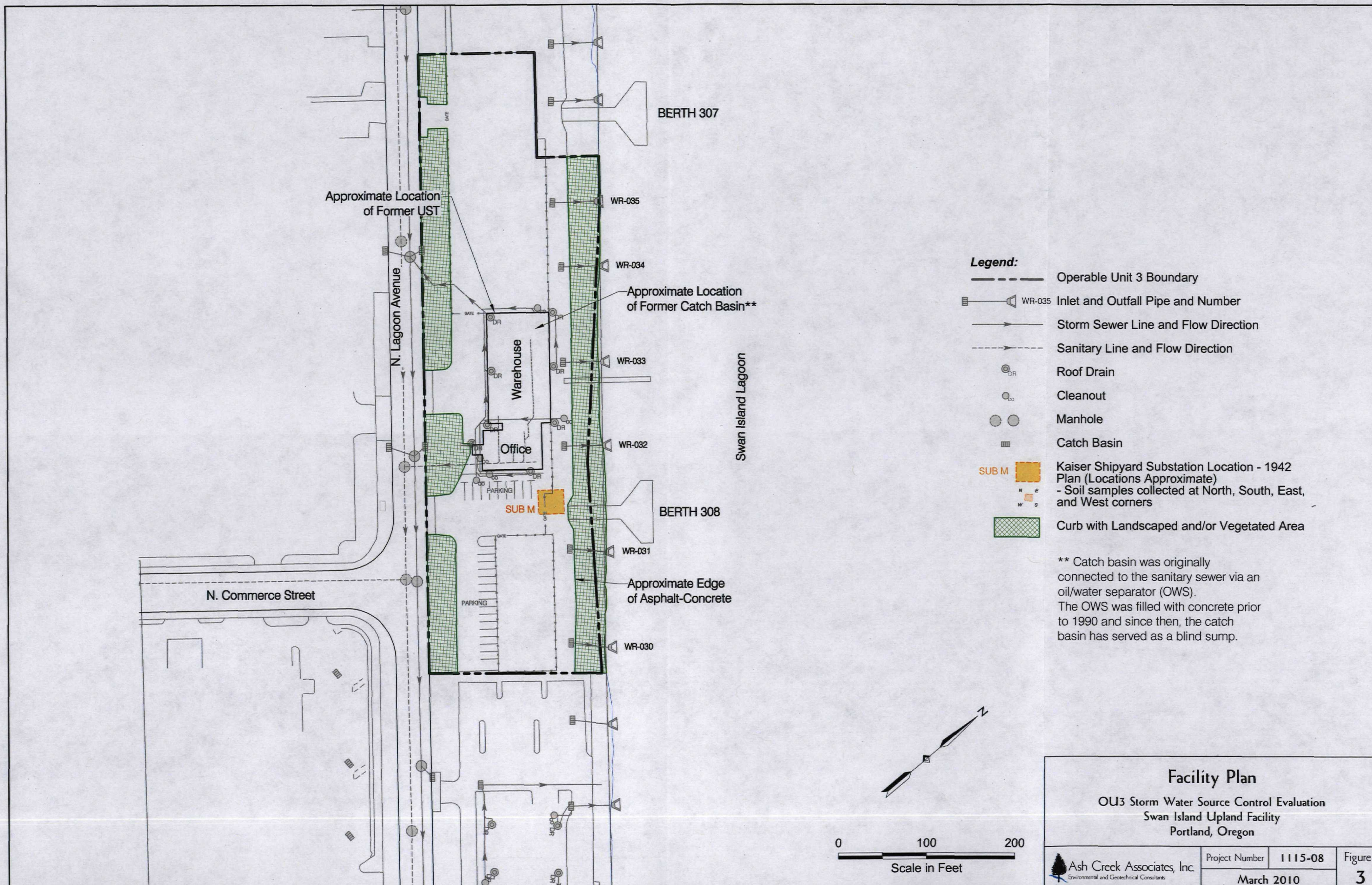
NOTE:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

Site Vicinity Map

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1115-08	Figure
March 2010		2

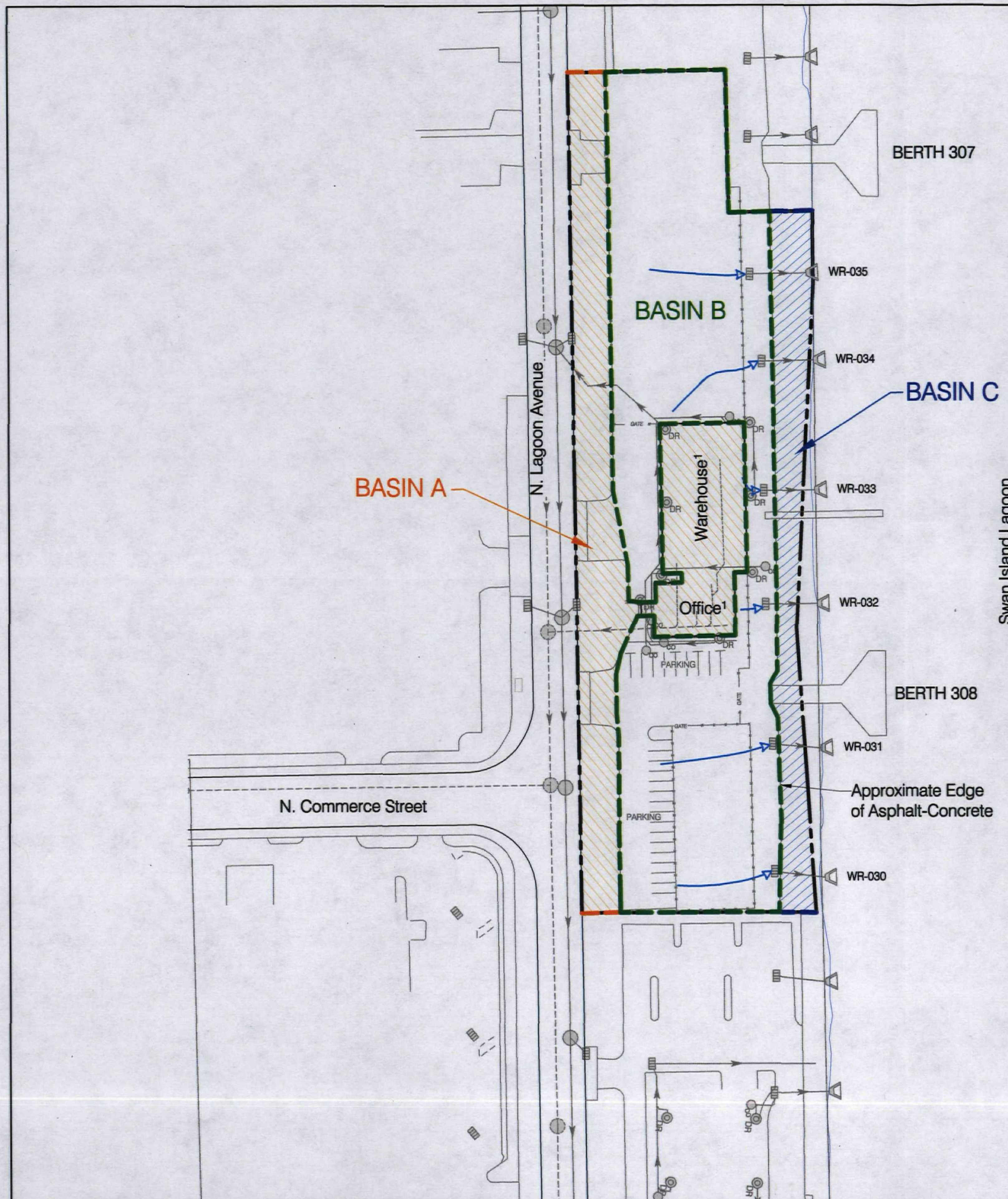


Facility Plan

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1115-08	Figure
March 2010		3



Legend:

- Operable Unit 3 Boundary
- WR-035 Inlet and Outfall Pipe and Number
- Storm Sewer Line and Flow Direction
- Sanitary Line and Flow Direction
- DR Roof Drain
- CO Cleanout
- Manhole
- Catch Basin
- Approximate Storm Water Flow Direction

[1] Building roof drains are connected to the public storm sewer that runs along N. Lagoon Avenue. Runoff from paved areas mainly discharges to inlets connected to 10-inch corrugated metal pipes. Runoff from driveways near N. Lagoon Avenue discharge by sheet flow to catch basins along N. Lagoon Avenue.

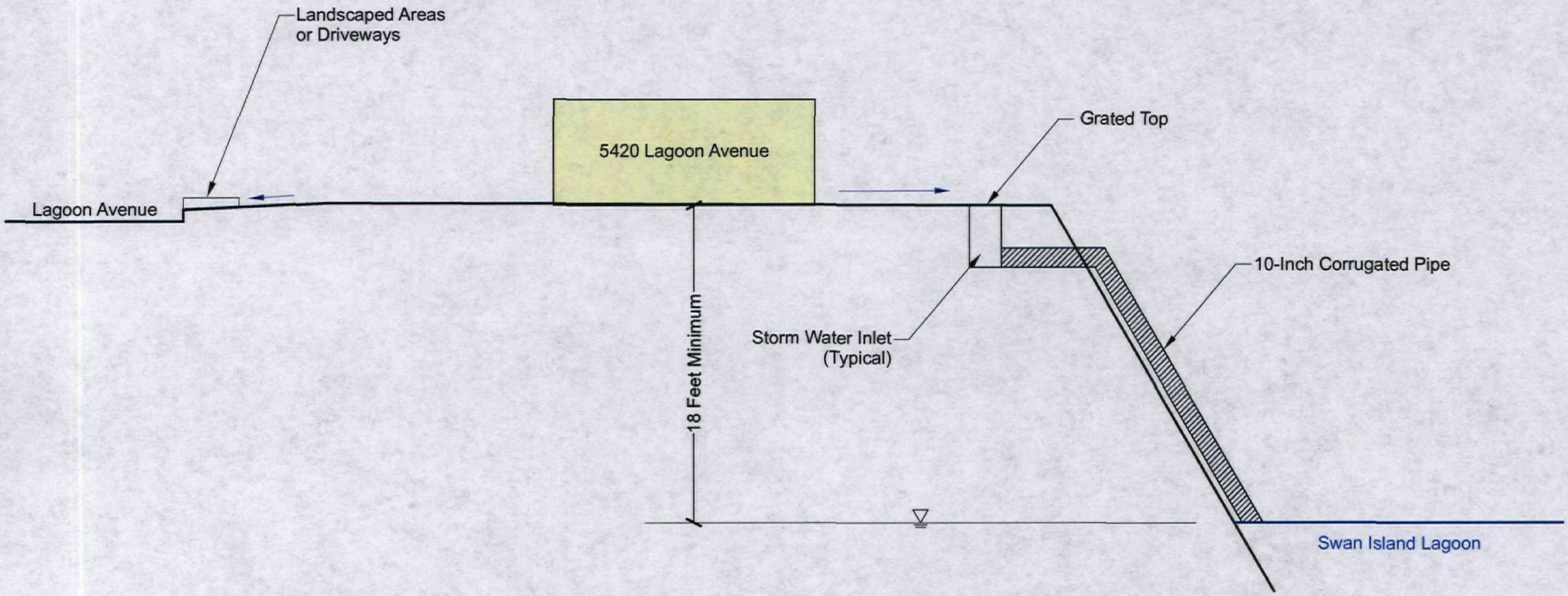
N

0 100 200
Scale in Feet

Storm Water Drainage Plan

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number	1115-08	Figure
	March 2010		4

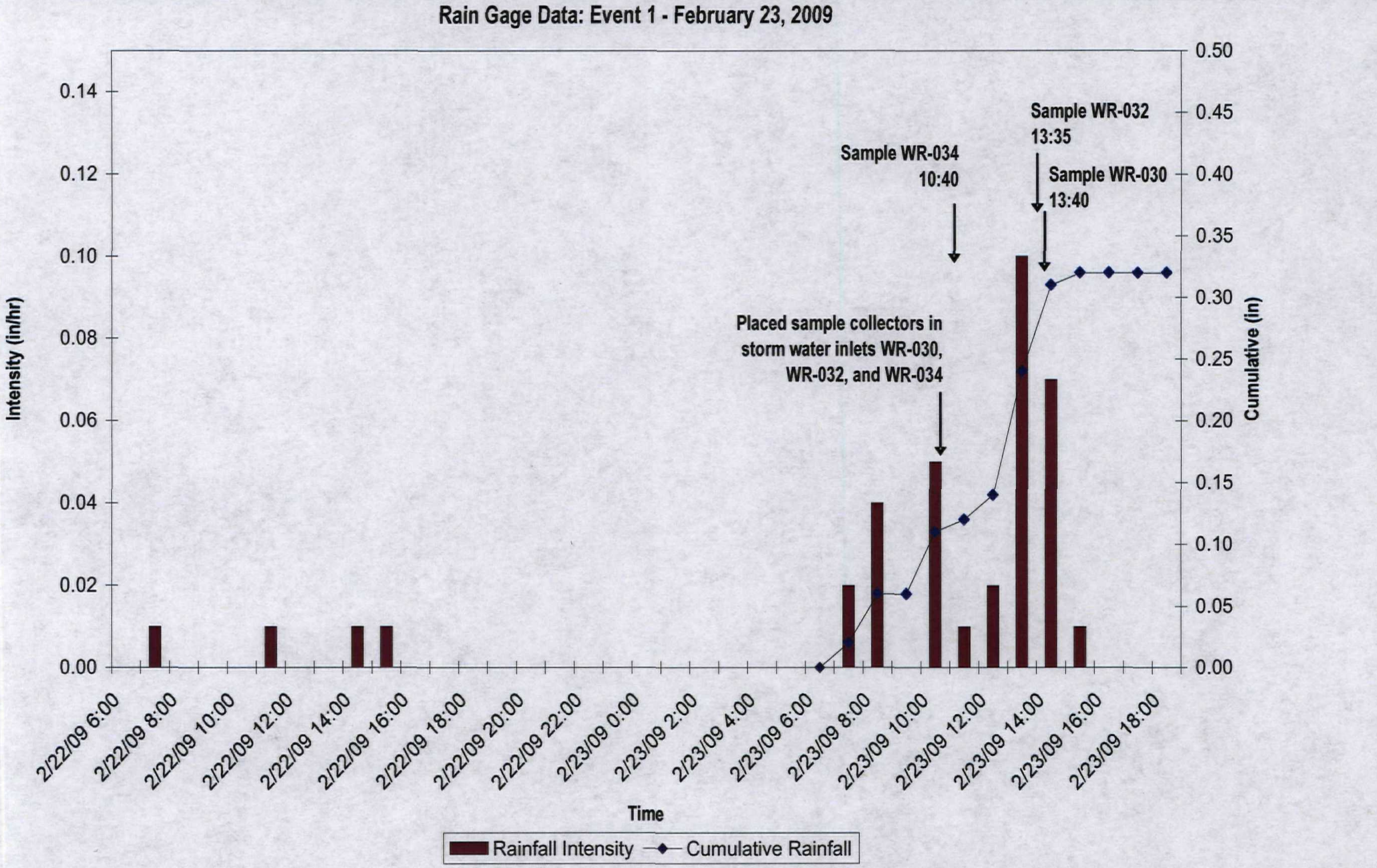


NOT TO SCALE

Storm Water Cross-Section Schematic

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

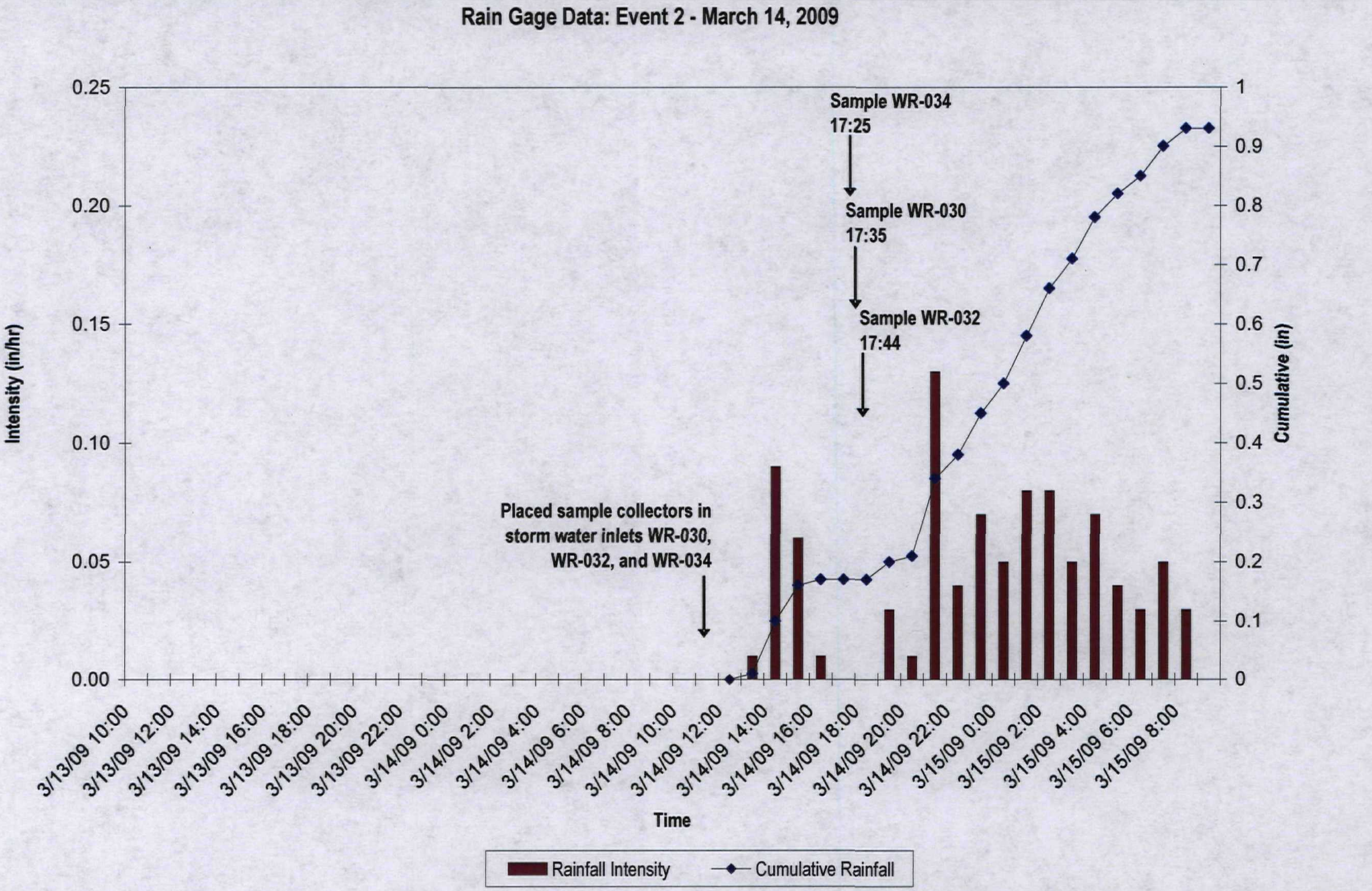
Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number	1115-08	Figure
	March 2010		5



Hydrograph (Event 1)

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number	1115-08	Figure
	March 2010		6

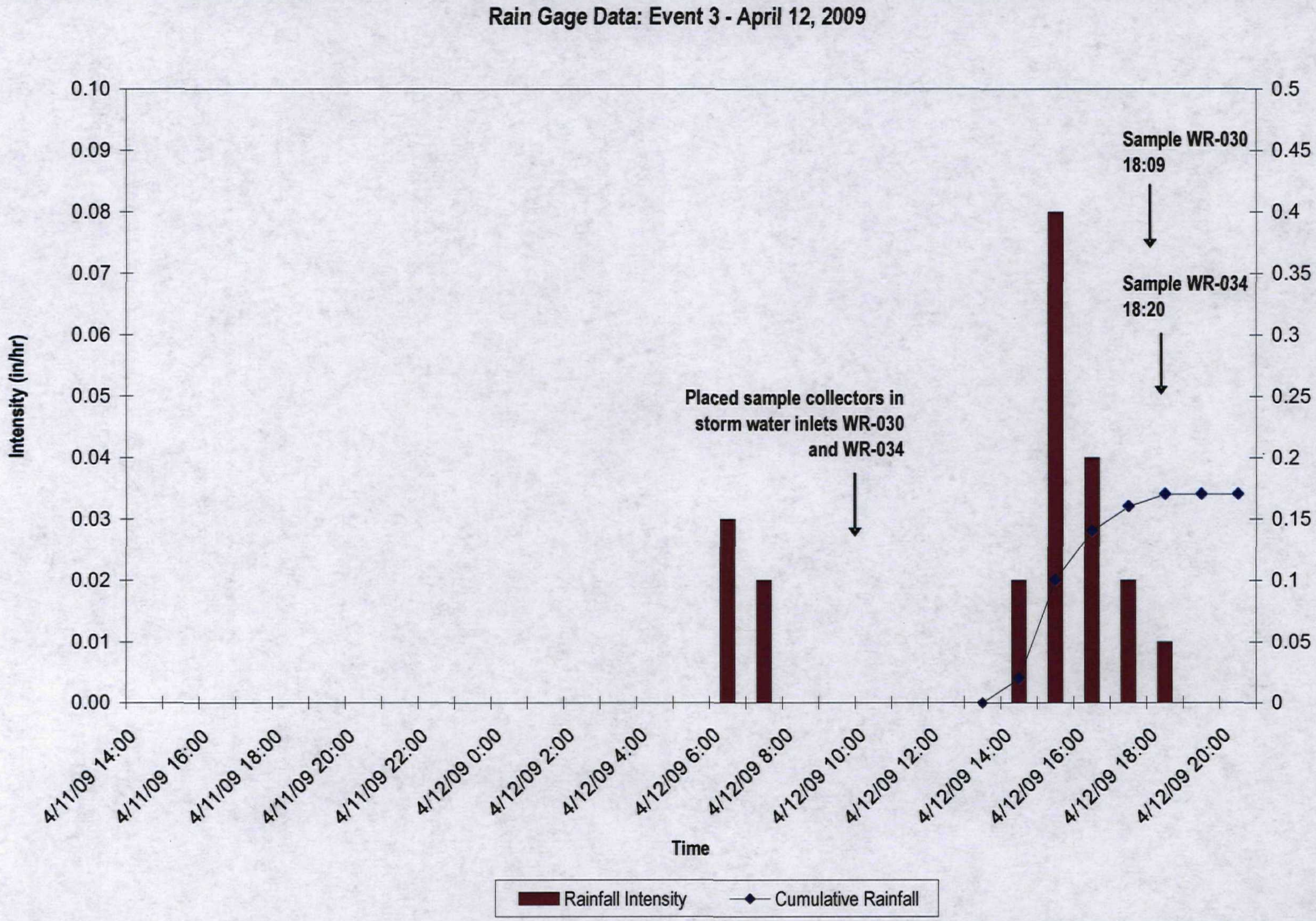


Hydrograph (Event 2)

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

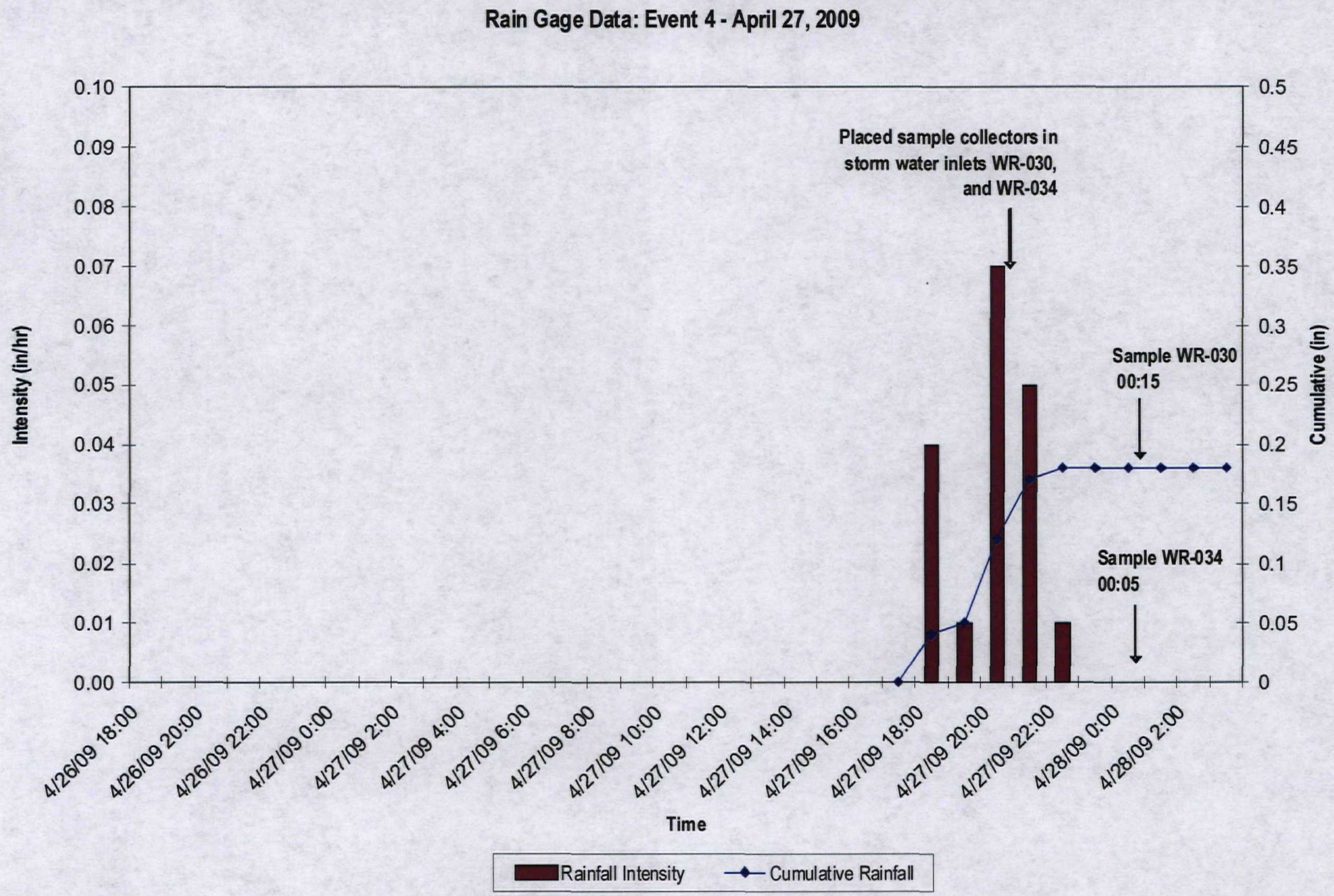
Project Number	1115-08	Figure
March 2010		7



Hydrograph (Event 3)

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number	1115-08	Figure
	March 2010		8



Hydrograph (Event 4)

OU3 Storm Water Source Control Evaluation
Swan Island Upland Facility
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1115-08	Figure
March 2010		9

Appendix A

Appendix A

Photograph Log

APPENDIX A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

Photo No: 1

Photo Date: July 21, 2008

Orientation: Southwest

Description:

Asphalt-concrete roadway along top of bank. Black hose along left edge of roadway is from storm water cleanout.

Absorbent boom was maintained by former tenant as part of SPCC Plan.

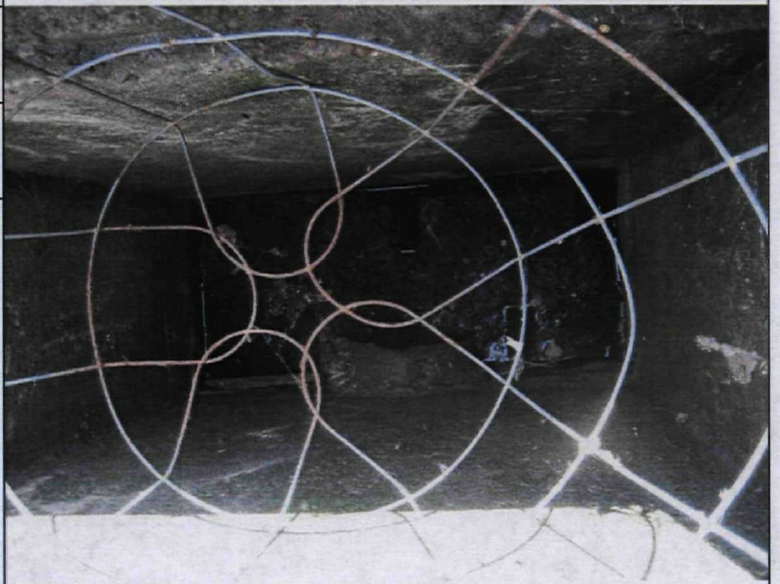
Photo No: 2

Photo Date: 7/21/2009

Orientation: Not Applicable

Description:

Storm water inlet consisting of a rectangular concrete sump with an outlet at the bottom. Coarse basket from historical sediment trap sitting in top of inlet.



APPENDIX A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

Photo No: 3

Photo Date: 7/21/2008

Orientation: Southwest

Description:

Example of the 10-inch corrugated metal pipes that discharge to the Swan Island Lagoon.

Cleanout of the outfall pipes conducted by boat from the Swan Island Lagoon.

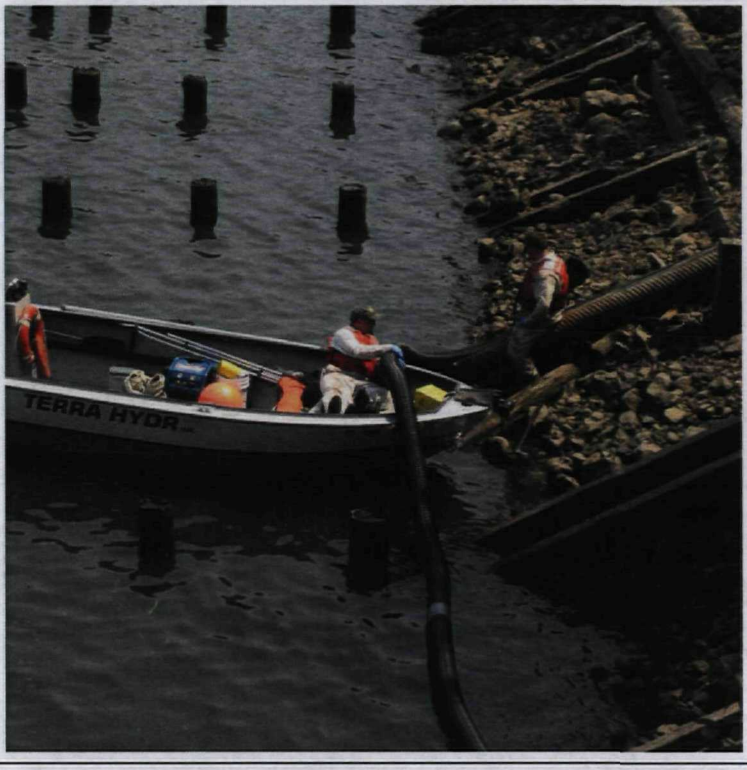


Photo No: 4

Photo Date: 9/22/2008

Orientation: South

Description:

Non-PCB transformer present on the Facility.

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

Photo No: 5

Photo Date: 9/22/2008

Orientation: Southwest

Description:

Used oil and engine coolant above-ground storage tanks (ASTs). Spill kit in right of photo.

Photo No: 6

Photo Date: 9/22/2008

Orientation: Southeast

Description:

Various drums on mobile spill platforms.

APPENDIX A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

Photo No: 7	
Photo Date: 3/14/2009	
Orientation: Southwest	
Description: Vegetation/moss on the asphalt-concrete surface along the top of the riverbank before the surface cleanup. Inlet WR-034 is near the center of the photo. Absorbent sock was maintained by former tenant as part of SPCC Plan.	

Photo No: 8	
Photo Date: 4/12/2009	
Orientation: Northwest	
Description: Inlet WR-034 area after surface cleanup with storm water sampling pan installed. Absorbent sock was replaced after sampling.	

APPENDIX A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

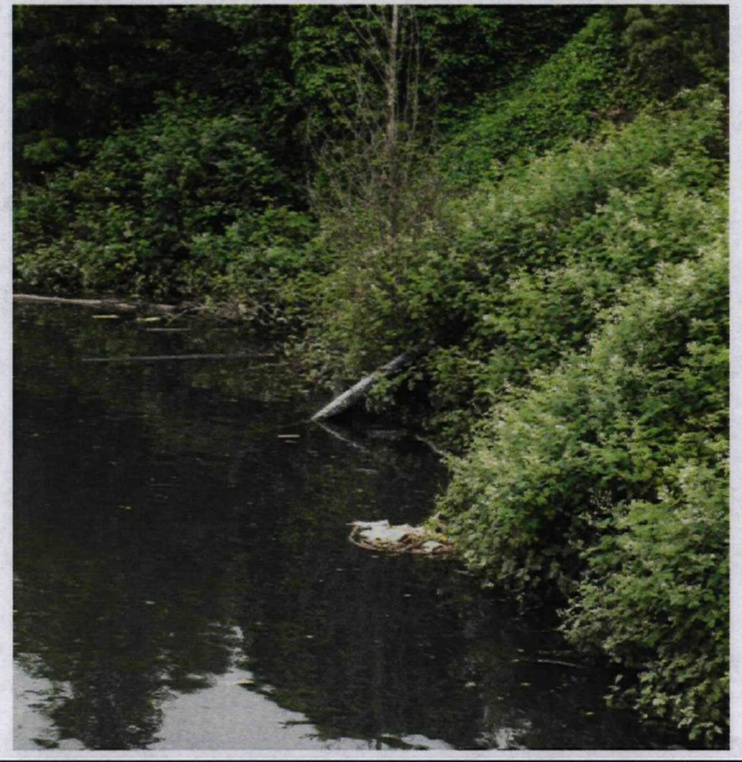
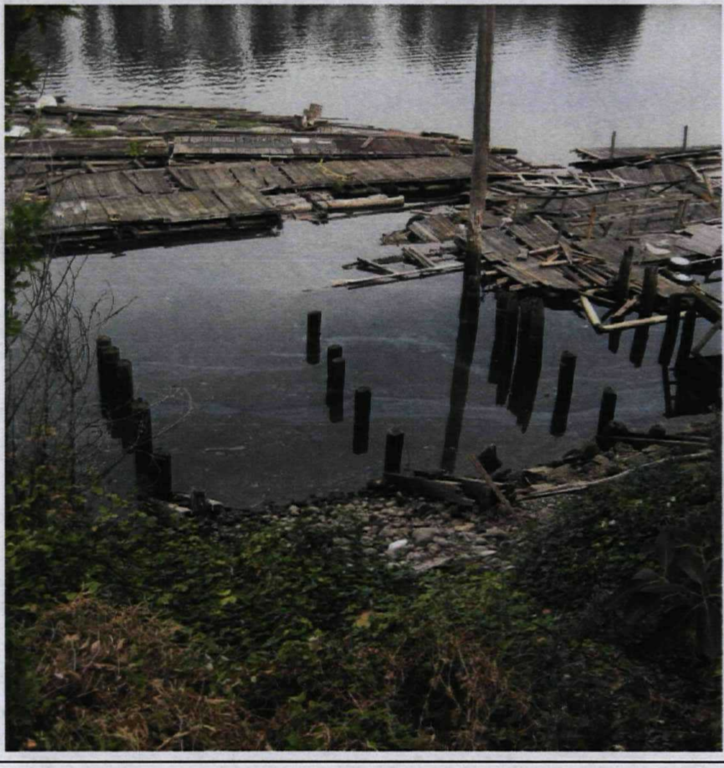
Photo No: 9	
Photo Date: 6/10/2008	
Orientation: Southeast	
Description: Storm water outfall submerged in Sawn Island Lagoon.	

Photo No: 10	
Photo Date: 10/1/2008	
Orientation: Northeast	
Description: Floating debris and sheen observed on surface water at the southern end of the Facility.	

APPENDIX A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

Photo No: 11	
Photo Date: 1/30/2009	
Orientation: Southeast	
Description: Photograph of southern end of Facility – no sheen observed.	

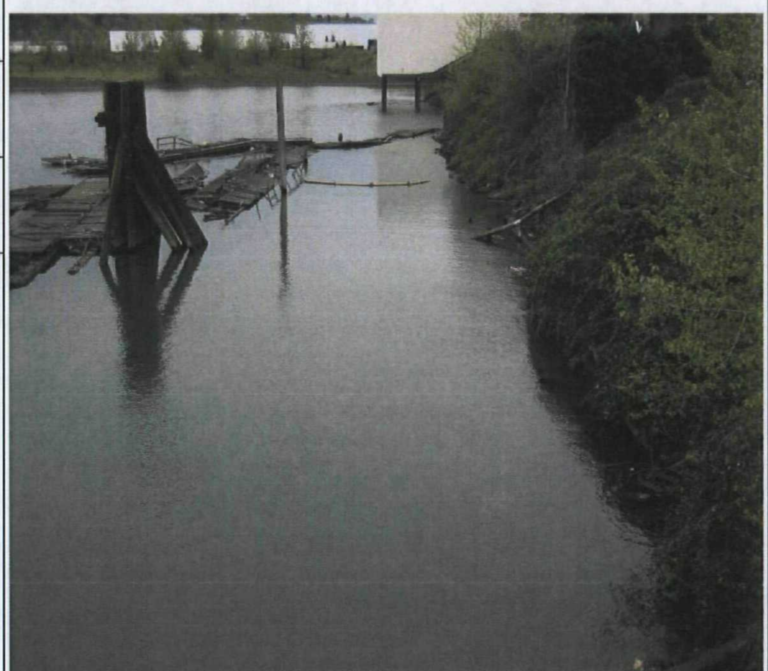
Photo No: 12	
Photo Date: 2/24/2009	
Orientation: Northeast	
Description: Photograph of southern end of Facility – no sheen observed.	

APPENDIX A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU3
Project Number: 1115-08

Client: Port of Portland
Location: Portland, Oregon

Photo No: 13 **Photo Date:** 3/14/2009 **Orientation:** Southeast **Description:** Photograph of southern end of Facility – no sheen observed.	

Photo No: 14 **Photo Date:** 4/12/2009 **Orientation:** Southeast **Description:** Photograph of southern end of Facility – no sheen observed.	

Appendix B

Appendix B

Project Documentation

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining grab-type water samples from storm drains, outfalls, flumes or surface waters for physical and/or chemical analysis. For a grab sample a discrete aliquot is collected representing a specific location at a given time. This SOP does not include collection of samples with an automated sampler. Various types of methods are used to collect grab water samples including peristaltic pumps, telescoping samplers, or directly filling laboratory-supplied sample containers. This procedure is applicable during all Ash Creek Associates (ACA) outfall water sampling activities.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Telescoping swing sampler; and/or peristaltic pump and tubing.
- Laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: accessibility of sampling point, sampling depth, and flow rate. Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling method. The project sampling plan should define the specific requirements for collection of outfall water samples at a particular site.

<u>Collection of Samples</u>

- Record weather conditions at the time of sampling and last known rain fall event(s). Record and describe site conditions upon arrival and during sampling..
- Collect samples using the "Clean Hands/Dirty Hands" sampling technique. Operations involving direct contact with the sample bottle, sample bottle lid, sample suction tubing, and the transfer of the sample from the sample collection device to the sample bottle are handled by "clean hands". "Dirty hands" is responsible for preparation of the sampler (except the sample container itself), operation of any machinery, and for all activities that do not involve handling items that have direct contact with the sample.
- The water sample can be collected directly by dipping a new laboratory supplied container (i.e. polyethylene, Teflon, or glass) into the water (just beneath the water surface) or under the flow path and filling. The liquid is then transferred to a laboratory supplied sample container. Be careful not to touch the sides of the vault, manhole, or outfall pipe.
- A telescoping swing sampler can be used if an extension is necessary to access the sample point. Attach a new laboratory supplied container (i.e. polyethylene, Teflon, or glass) to the sampler. This transfer device is used to transfer liquid from the sampling point to a sample bottle. Avoid using metal transfer devices for trace-metal analysis or plastic devices for sampling trace organics.
- A peristaltic pump with disposable tubing can be used to collect a water sample from a manhole. The downhole tubing can be attached to a telescoping sampling pole to provide better control. Lower the tubing downstream of any standing water and take care to avoid stirring up the sediment.

TI 2083346

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: CESQG
2. Page 1 of: 1 of 1
3. Emergency Response Phone: 800 483 3718
4. Manifest Tracking Number: 001388884 FLE

5. Generator's Name and Mailing Address: Port of Portland c/o Ash Creek, 9615 SW Allen Blvd #106, Beaverton, OR 97005
Generator's Phone: 224 3286
Generator's Site Address (if different than mailing address): 5420 N. Lagoon, Portland, OR 97217

6. Transporter 1 Company Name: Waste Xpress — U.S. EPA ID Number: ORQ 0000 23150

7. Transporter 2 Company Name: CLEAN HARBORS ENV. SVCS — U.S. EPA ID Number: MAD039322250

8. Designated Facility Name and Site Address: Clean Harbors - Aragonite LLC, 11600 N. Aptus Rd, Aragonite UT 84029 — U.S. EPA ID Number: UTD981552177
Facility's Phone: 801-323-8100

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
RQ	1. Hazardous Waste Liquids, N.O.S. (Lead), 9, NA3082, PG III	1	DM	15	G	D008
	2.					
	3.					
	4.					

Received OCT 2 0 2008 Ash Creek

14. Special Handling Instructions and Additional Information: (1) CH331261 ERG# 171 Job# 8952

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Jenny Kamp Per Ash Creek — Signature: [signature] — Month 9 Day 30 Year 08

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Steve DeLamar — Signature: [signature] — Month 9 Day 30 Year 08
Transporter 2 Printed/Typed Name: Richard Smith — Signature: [signature] — Month 10 Day 03 Year 08

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)
1. H141 2. 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Tina Peterkin — Signature: [signature] — Month 10 Day 15 Year 08

GENERATOR / INT'L / TRANSPORTER / DESIGNATED FACILITY

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

7I208334

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)	21. Generator ID Number CESQG	22. Page 2 of 2	23. Manifest Tracking Number 001388884 FLE

24. Generator's Name PORT OF PORTLAND

25. Transporter 3 Company Name SLT EXPRESS — U.S. EPA ID Number UTK000007708

26. Transporter 4 Company Name Clean Harbors — U.S. EPA ID Number MAD039322250

GENERATOR

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes
	TRANSPORT ONLY					
						Received OCT 20 2008 Ash Creek

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 3 Acknowledgment of Receipt of Materials

Printed/Typed Name: Douglas Dannor — Signature: [signature] — Month 10 Day 3 Year 08

34. Transporter 4 Acknowledgment of Receipt of Materials

Printed/Typed Name: Shelly Pritchett — Signature: Shelly Pritchett — Month 10 Day 6 Year 08

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)	21. Generator ID Number CESQG	22. Page 3	23. Manifest Tracking Number 001388884

24. Generator's Name Port of Portland c/o Ash Creek

25. Transporter 5 Company Name Clean Harbors U.S. EPA ID Number MAD039322250

26. Transporter ______ Company Name U.S. EPA ID Number

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes
	Form Only					Received OCT 20 2008 Ash Creek

32. Special Handling Instructions and Additional Information

GENERATOR

33. Transporter 5 Acknowledgment of Receipt of Materials

Printed/Typed Name Kirk Wilson Signature Keith Wilson Month 10 Day 15 Year 08

34. Transporter ______ Acknowledgment of Receipt of Materials

Printed/Typed Name Signature Month Day Year

TRANSPORTER

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

DESIGNATED FACILITY

Michael

CASCADE GENERAL
PORTLAND SHIPYARD

INVOICE 201375

REMIT TO:
Attn: Victoria Miller, Acct Rec.
P.O. Box 4367
Portland, OR 97208-24367

Phone: (503) 247-1802
Fax: (503) 247-1854

Received
AUG 01 2008
Ash Creek

INVOICE DATE: 07/31/2008

CUSTOMER P.O.:
CUSTOMER #: 247

JOB NUMBER: 1-051-0003
JOB DESCRIPTION: ASH CREEK ASSOCIATES

ASH CREEK ASSOCIATES
ATTN: A/P DEPARTMENT
9615 SW ALLEN BLVD, STE 106
BEAVERTON, OR 97005

PAYMENT DUE ON: 8/30/2008

DESCRIPTION	QUANTITY	UOM	PRICE	AMOUNT
Wastewater Processing Trans Ticket: 3431	1,250	GAL	0.1300	$162.50
Wastewater Processing Trans Ticket: 3435	300	GAL	0.1300	$39.00
Wastewater Processing Trans Ticket: 3444	800	GAL	0.1300	$104.00
Wastewater Processing Trans Ticket: 3447	120	GAL	0.1300	$15.60

3431 = 003

3435/3444/3447 = 002

SUBTOTAL: $321.10

INVOICE TOTAL: $321.10

Cascade General Inc.
5555 N. Channel Avenue
Portland, OR 97217
Phone (503) 285-1111
Fax (503) 247-1854

Wire Transfer Payment Instructions:
Cascade General, Inc.
Key Bank
1211 SW 5th Avenue, Portland OR 97204
Account No. 379 68101 61 09
ABA: 123 002 011

SC

Appendix C

Appendix C

Analytical Laboratory Reports and Data Quality Review (contained on CD-ROM)

1.0 Introduction

This appendix documents the results of a quality assurance (QA) review of the analytical data for storm water samples collected as part of the Swan Island Upland Facility (SIUF) Operable Unit 3 (OU3) Storm Water Project. The data reviewed includes storm water sample data collected during sampling performed beginning February 23, 2009 through April 28, 2009. The samples were analyzed by TestAmerica, Inc. of Beaverton, Oregon.

The QA review outlines the applicable quality control (QC) criteria used during the data review process, as well as any deviations from those criteria. Examination and validation of the laboratory summary report includes:

- Analytical methods;
- Reporting limits;
- Detection limits and estimated concentrations;
- Sample holding times;
- Custody records and sample receipt;
- Spikes, blanks, and surrogates;
- Duplicates; and
- Calibration and internal standard.

The QA review did not include a review of raw data. Section 2 lists the analytical methods used in sample analysis. Section 3 defines the QA terms used in this report. Section 4 provides the QA results for each sampling event. Section 5 lists the qualifiers used in the tabulated results. A list of abbreviations used in this report is included at the end of this document for reference.

2.0 Analytical Methods

Chemical analyses on storm water samples consisted of one or more of the following, unless otherwise noted:

- Total Suspended Solids (TSS) by U.S. Environmental Protection Agency (EPA) Method 160.2;
- Total petroleum hydrocarbons (TPH) as diesel (TPHd) and residual-range organics (silica gel-treated) by Method NWTPH-Dx;
- TPH as gasoline (TPHg) by Method NWTPH-Gx;
- Total Metals (As, Cd, Cu, Hg, Pb, Zn, and Hg) by EPA 6000/7000 series;

- Phthalates (semi-volatile organics) by EPA Method 8270 SIM;
- Total and dissolved polychlorinated biphenyl (PCB) Aroclors by EPA Method 8082;
- Polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270C SIM; and
- Tributyltin (TBT) by the Krone Method.

3.0 QA Objectives and Review Procedures

The general QA objectives for this project were to develop and implement procedures for obtaining, evaluating, and confirming the usability of data of a specified quality for monitoring upland storm water. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain-of-custody (COC) procedures.

Reporting limits and analytical results were compared to action levels for each parameter in the media of concern. Precision, accuracy, representativeness, completeness, and comparability parameters used to indicate data quality are defined below.

Reporting Limits. Method reporting limits (MRLs) are set by the laboratory and are based on instrumentation abilities, sample matrix, and MRLs suggested by the EPA or the Oregon Department of Environmental Quality (DEQ). In some cases, the MRLs are raised due to high concentrations of analytes in the samples or matrix interferences. MRLs are generally consistent with industry standards and below promulgated regulatory standards when possible (if not raised, as discussed above).

Detection Limits and Estimated Concentrations. The method detection limit (MDL) is the lowest quantity of a substance that can be distinguished from the absence of that substance within a stated confidence limit. The MDL is estimated from the mean of the blank, the standard deviation of the blank, and some confidence factor. Performing the sample preparation has potential to underestimate the true MDL.

Holding Times. Holding times are the length of time a sample can be stored after collection and prior to analysis without significantly affecting the analytical results. Holding times vary with the analyte, sample matrix, and analytical methodology used to quantify the analyte concentration.

Custody Records and Sample Receipt. COC refers to the document or paper trail showing the seizure, custody, control, transfer, analysis, and disposition of physical and electronic evidence. The sample receipt identifies the condition of samples upon arrival at the analytical laboratory.

Method Blanks. A method, or laboratory, blank is a sample prepared in the laboratory along with the actual samples and analyzed for the same parameters at the same time. It is used to assess if detected contaminants may have been the result of contamination of the samples in the laboratory.

Laboratory Control Sample. A laboratory control sample (LCS) is analyzed by the laboratory to assess the accuracy of the analytical equipment. The sample is prepared from an analyte-free matrix that is then spiked with known levels of the constituents of interest (i.e., a standard). The concentrations are measured and the results compared to the known spiked levels. This comparison is expressed as percent recovery.

Laboratory Control Sample Duplicate. In addition, a second laboratory control sample (i.e., the laboratory control sample duplicate [LCSD]) is prepared as above and analyzed. This is compared to the initial laboratory control sample to assess the precision of the analytical method (i.e., relative percent difference [RPD]).

Matrix Spike Analyses. Matrix spike (MS) analyses are performed on samples submitted to the laboratory that are of the same matrix as the actual sample. The MS is spiked with known levels of the constituents of interest. These analyses are used to assess the potential for matrix interference with recovery or detection of constituents of interest and the accuracy of the determination. The spiked sample results are compared to the expected result (i.e., sample concentration plus spike amount) and reported as percent recovery.

Laboratory Duplicate. A laboratory duplicate is a second analysis of the QA/QC sample, which serves as an internal check on laboratory quality as well as potential variability of the sample matrix. The laboratory duplicate is analyzed and compared to the primary sample analysis to assess the precision of the analytical method. This comparison can be expressed by the RPD between the original and duplicate samples.

Surrogate Recovery. Surrogates are organic compounds that are similar in chemical composition to the analytes of interest and spiked into environmental and batch QC samples prior to sample preparation and analysis. Surrogate recoveries for environmental samples are used to evaluate matrix interference on a sample-specific basis.

Field Duplicate. A field duplicate is a second field sample collected from a selected monitoring well. Field duplicate samples serve as a check on laboratory quality as well as potential variability of the sample matrix. The field duplicate is analyzed and compared to the first sample to assess the precision of the analytical method. This comparison can be expressed by the RPD between the original and duplicate samples.

Calibration. Satisfactory instrument calibration is established to confirm that an instrument is capable of producing acceptable quantitative data. An initial calibration verification (ICV) demonstrates that the instrument is capable of acceptable performance at the beginning of an experimental sequence. Continuing calibration verifies (CCV) that the daily performance of the instrument is satisfactory.

Internal Standard. An internal standard is a chemical substance that is added in a constant amount to samples, the blank, and calibration standards in a chemical analysis. This substance is then used for calibration by plotting the ratio of the analyte signal to the internal standard signal as a function of the analyte concentration of the standards. This is done to correct loss of analyte during sample preparation.

4.0 QA/QC Review Results

The following subsections document the results of the QA review for each sampling event.

4.1 February 23, 2009 Event

The data reviewed include storm water sample data collected during sampling performed on February 23, 2009. Samples WR-030, WR-032, and WR-034 were analyzed for one or more of the following: TSS, metals, TPH (gasoline-, diesel-, and residual-range), phthalates, PAHs, PCB Aroclors (total and dissolved), and TBT using the methods listed in Section 2.

Reporting Limits. Elevated MRLs of analytes consisted of the following:

> PAHs. Reporting limits for benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene were raised due to sample matrix effects. The matrix interference prevented adequate resolution of the target compounds at the MRL. The results were flagged with an "RL1".

MRLs were reviewed and are generally acceptable for this project. MRLs for individual samples varied based on the magnitude of the chemical impact. The MRLs for arsenic, cadmium, lead, and PCB Aroclors 1221, 1232, 1242, 1248, 1254, and 1260 were higher than the applicable screening level.

Detection Limits and Estimated Concentrations. MDLs were suitable for their intended use.

Holding Times. Analyses were completed within specified hold times.

Custody Records and Sample Receipt. Samples were received outside temperature requirements (within 4 hours of sample time) and consistent with the accompanying COC.

Method Blanks. No analytes were detected in the method blanks.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits for TSS, TPHd, TPHg, metals, phthalates, PCB Aroclors, PAHs, and TBT.

Laboratory Control Sample Duplicate. LCSDs were analyzed for for TSS, TPHd, TPHg, phthalates, PCB Aroclors, and PAHs, and were within the control limits.

Matrix Spike Analyses. Two MS samples were analyzed for metals. On the first, zinc recovery was moderately outside of the control limits. On the second, all recoveries were within control limits for metals. MS analyses were not conducted for the other analytes.

Laboratory Duplicate. Laboratory duplicates were analyzed for TPHg, TSS, and metals. All RPDs were within control limits.

Surrogate Recovery. Surrogate recoveries were within quality control limits with the exception of:

NWTPH-Dx. Sample matrix effects caused the surrogate (1-chlorooctadecane) recovery to fall below acceptable limits.

NWTPH-Gx. Laboratory sample ID PSB0642-01 was analyzed, but not reported because surrogate recovery was outside established control limits (biased high). The sample was re-prepared, reported, and flagged "RE1".

Field Duplicate. A field duplicate sample was not collected.

Calibration. Calibration standards were within QC limits.

4.2 March 14, 2009 Event

The data reviewed include storm water sample data collected during sampling performed on March 14, 2009. Samples WR-030, WR-032, and WR-034 were analyzed for one or more of the following: TSS, metals, TPH (gasoline-, diesel-, and residual-range), phthalates, PAHs, PCB Aroclors (total and dissolved), and TBT using the methods listed in Section 2.

Reporting Limits. MRLs were reviewed and are generally acceptable for this project. MRLs for individual samples varied based on the magnitude of the chemical impact. The MRLs for arsenic, cadmium, and lead, as well as PCB Aroclors 1221, 1232, 1242, 1248, 1254, and 1260 exceeded the applicable screening level.

Detection Limits and Estimated Concentrations. No samples had estimated concentrations. MDLs for PCB Aroclors were above applicable screening levels.

Holding Times. All Samples were analyzed within holding times.

Custody Records and Sample Receipt. The samples were received below the required temperature of 4°C. The samples were intact, on ice, and consistent with the accompanying COC.

Method Blanks. Blank results for all analyses were non-detect.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits for TSS, metals, TPH, phthalates, PCB Aroclors, PAHs, and TBT.

Laboratory Control Sample Duplicate. LCSDs were analyzed for mercury, TPH, phthalates, PCB Aroclors, PAHs, and TBT, and were within the control limits.

Matrix Spike. Percent recoveries of the MS were within control limits for metals and mercury. There was no MS/MSD analyzed for TSS, TPH, phthalates, PCBs, PAHs, or TBT. The laboratory case narrative notes that, due to high levels of zinc in the source, sample 9030613-MS2 does not provide useful spike recovery information for EPA 6020 QC batch 9030613.

Matrix Spike Duplicate. An MSD was analyzed for mercury and was within the control limits.

Laboratory Duplicate. The laboratory duplicates for TSS, metals, and TPH were within QC limits. No laboratory duplicate was analyzed for phthalates, PCB Aroclors, PAHs, or TBT.

The laboratory noted that TPHg results for 9030644-DUP2 was partly due to individual peaks in the quantification range.

Surrogate Recovery. Surrogate recoveries were within QC limits.

Field Duplicate. A field duplicate sample was not collected.

Calibration. Calibration standards were within QC limits.

4.3 April 12, 2009 Event

The data reviewed include storm water sample data collected during sampling performed on April 12, 2009. Samples WR-030 and WR-034 were analyzed for one or more of the following: TSS, metals, TPH (gasoline-, diesel-, and residual-range), phthalates, PAHs, PCB Aroclors (total and dissolved), and TBT using the methods listed in Section 2.

Reporting Limits. The MRLs for two metals (arsenic and cadmium) were higher than the applicable screening level in one or more samples.

Holding Times. Analyses were completed within specified hold times.

Detection Limits and Estimated Concentrations. No MDL outliers were identified during the QA/QC review.

Custody Records and Sample Receipt. The samples were received below the required temperature of 4°C. The samples were received consistent with the accompanying COC.

Method Blanks. Blank results for all analyses were non-detect.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits for TSS, metals, TPH, phthalates, PCB Aroclors, PAHs, and TBT.

Laboratory Control Sample Duplicate. Percent recoveries and RPDs for the LCSDs were within control limits for mercury, TPH, phthalates, PCB Aroclors, and PAHs. There was no LCSD analyzed for TSS, metals, or TBT.

Matrix Spike Analyses. Percent recoveries of the MS/MSDs were within control limits for mercury and metals, except for copper. Copper recovery for the MS was slightly below established control limits.

Laboratory Duplicate. The laboratory duplicates for TSS, mercury, and TPHg were within QC limits.

Surrogate Recovery. Surrogate recoveries were within QC limits.

Field Duplicate. A field duplicate sample was not collected.

Calibration. Calibration standards were within QC limits.

4.4 April 28, 2009 Event

The data reviewed include storm water sample data collected during sampling performed on April 28, 2009. Samples WR-030 and WR-034 were analyzed for one or more of the following: TSS, metals, TPH (gasoline-, diesel-, and residual-range), phthalates, PAHs, PCB Aroclors, and Tri Butyl Tin using the methods listed in Section 2.

Reporting Limits. Elevated MRLs of analytes consisted of the following:

- TPHd. Reporting limits were raised due to insufficient sample volume for NWTPHDx. The data was flagged with a "RL4" qualifier.

MRLs were reviewed and are generally acceptable for this project. MRLs for individual samples varied based on the magnitude of the chemical impact. MRLs for arsenic, cadmium, and PCB Aroclors were higher than the applicable screening level in one sample.

Detection Limits and Estimated Concentrations. No MDL outliers were identified during the QA/QC review.

Holding Times. Analyses were completed within specified hold times.

Custody Records and Sample Receipt. The samples exceeded the required temperature of 4°C (the gallon-sized sample containers were not able cool to the required temperature before receipt at the laboratory). This does not affect the data quality.

Method Blanks. Blank results for all analyses were non-detect.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits.

Laboratory Control Sample Duplicate. Percent recoveries of the LCSD were within control limits.

Matrix Spike Analyses. Percent recoveries of the MS/MSDs were within control limits for the samples analyzed for mercury and metals. There were no MS/MSDs analyzed for TSS, PAHs, TPH, phthalates, or PCB Aroclors. A summary of MS exceptions for phthalates is provided below.

Laboratory Duplicate. The laboratory duplicates for TPHg, mercury, and metals were within QC limits. No laboratory duplicates were analyzed for PAHs, phthalates, TSS, or PCB Aroclors.

Surrogate Recovery. Surrogate recoveries were within QC limits.

Field Duplicate. No field duplicates were collected.

Calibration. Calibration standards were within QC limits.

5.0 Qualifiers

No qualifiers were used in the tabulated data.

Abbreviations:

CCV = Continuing Calibration Verification
COC = Chain-of-Custody
DEQ = Department of Environmental Quality
DL = Sample-specific Estimated Detection Limit
EPA = U.S. Environmental Protection Agency
ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy
ICV = Initial Calibration Verification
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MDL = Method Detection Limit
µg/L = Micrograms per Liter
MRL = Method Reporting Limit
MS = Matrix Spike
MSD = Matrix Spike Duplicate
ng/L = Nanograms per Liter
OU3 = Operable Unit 3
PAH = Polynuclear Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
pg/L = Picograms per Liter
QA/QC = Quality Assurance/Quality Control
RPD = Relative Percent Difference
RSD = Relative Standard Deviation
SUIF = Swan Island Upland Facility
TBT = Tributyltin
TPH = Total Petroleum Hydrocarbons
TSS = Total Suspended Solids

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APPENDIX C